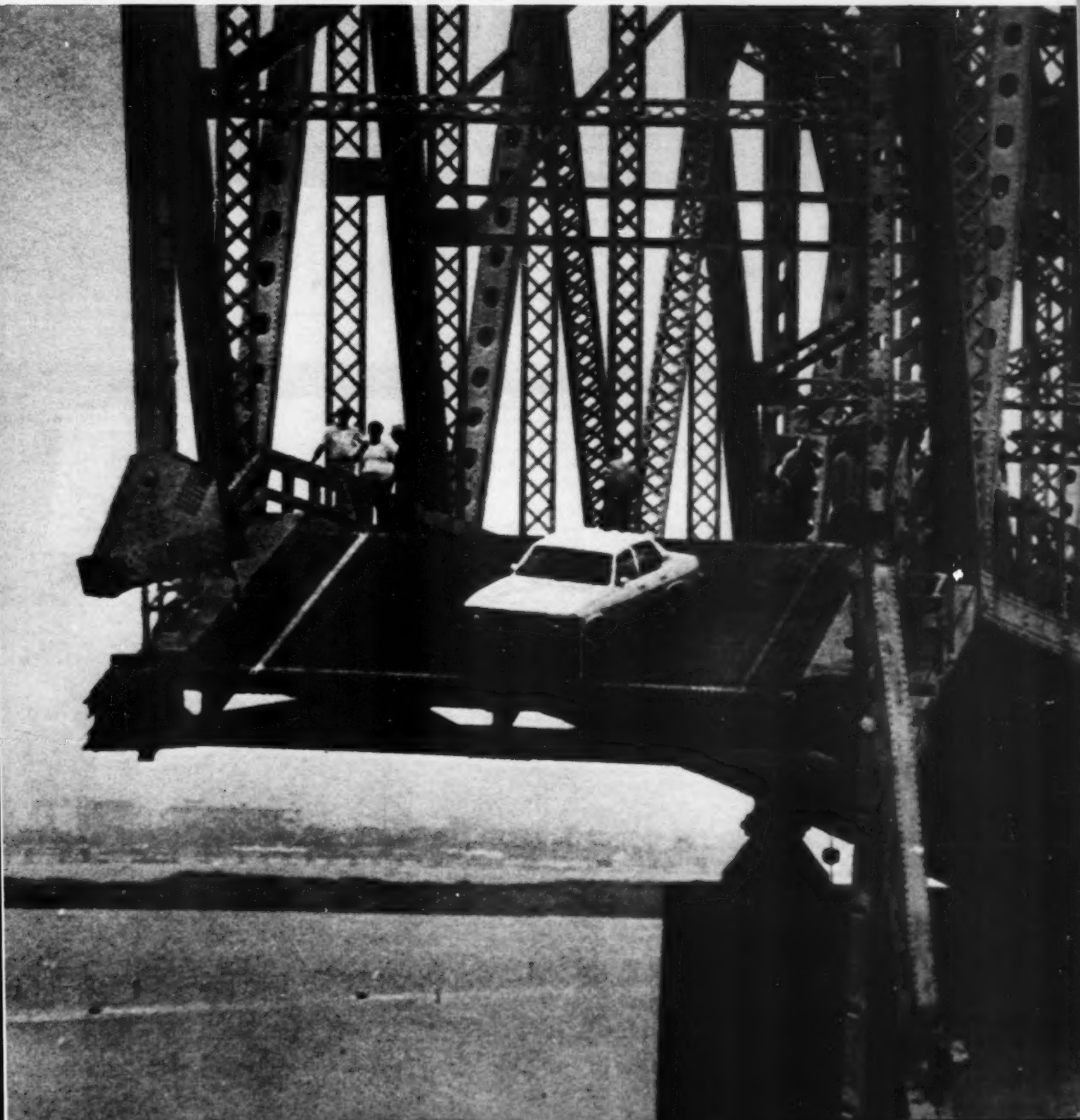
July-August 1980
Volume 24
Number 4

Mariners Weather Log

DEPARTMENT OF COMMERCE • UNITED STATES OF AMERICA •

National Oceanic and Atmospheric Administration • Environmental Data and Information Service



Mariners Weather Log

Editor: Elwyn E. Wilson
Editorial Assistant: Annette Farrall

July-August 1980
Volume 24 Number 4
Washington, D.C.

Routing
Master ____________

Observing Officers
____
____
____

Radio Officer ____________

PARTICIPATE IN AMVER

PLEASE PASS THIS ISSUE ALONG

U.S. DEPARTMENT OF COMMERCE
Philip M. Klutznick, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Richard A. Frank, Administrator

ENVIRONMENTAL DATA AND INFORMATION SERVICE.
Thomas D. Potter, Director

Front cover: A lucky car that stopped in time sits at the edge of the west span of the broken Sunshine Skyway Bridge after the SUMMIT VENTURE rammed the bridge during a thunderstorm and knocked down approximately 900 ft of the west span. Wide World Photo.

Back cover: Supertyphoon Tip near its maximum intensity of 160 kn on October 11, 1979, at 2127. The minimum sea-level pressure was near 870 mb, a new record, and the associated circulation pattern was 1,200 mi in diameter, also a new record. (DMSP Imagery)

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1983.

The Mariners Weather Log (ISSN:0025-3367) is published bimonthly by the National Oceanographic Data Center, Environmental Data and Information Service, NOAA, Washington, DC 20235 (telephone: 202-634-7394). For address change or cancellation, write to the Editor at this address. Copies are available to persons or agencies with a marine interest by writing to the Editor, Mariners Weather Log. Controlled circulation postage paid to Finance Department, USPS, Washington, DC 20260.

Mariners Weather Log

COASTAL STORMS IN SOUTHERN CALIFORNIA

Roger G. Pappas
National Weather Service, NOAA
Los Angeles, Calif.

For the second time in 3 yr and the third time in 12 yr, a series of devastating rainstorms struck Southern California again this year. The storms of February 13 to 21, 1980, were not as long-lasting as those of February and March 1978 or of January 1969. However, this 9-day period was among the wettest and most destructive short-storm periods ever recorded in the region.

Eighteen deaths were directly attributed to the storms, and early estimates of property damage totaled $270 million.

SYNOPTIC PATTERN

The flow pattern that caused the storms is illustrated by the 500-mb analysis for 0000 on the 17th (fig. 1). A stationary blocking HIGH was over Alaska with low pressure dominating the northeast Pacific. A region of sharp north-south temperature contrasts developed between the cold LOWs and the Tropics. This set up a strong jetstream at low latitudes, between 25° and 35°N. Storm centers were constantly being generated along the northern side of the jetstream between 35° and 42°N.

This weather pattern is also illustrated by the corresponding surface analysis and satellite imagery for 1800 on the 16th (figs. 2 and 3). A series of storms stretched nearly across the entire Pacific. Long fetches of warm moist air originating in the Tropics can be seen associated with two frontal systems. Storm rainfall was enhanced by both instability and orographic lifting as the tropical air flowed over the mountains of Southern California.

Heavy rains in January contributed to the destruction as the February rain fell on already wet ground.

SIX STORMS IN 9 DAYS

Six main storm systems occurred during February 13 to 21. Storms 1, 2, and 3 are shown in the satellite picture at 1745 on the 13th (fig. 4). At this time, Storm 1 consisted of three comma-shaped bands. One band was through southeastern California, western Arizona, and northern Baja California; the second was over Los Angeles; and the third was near 29°N, 123°W.

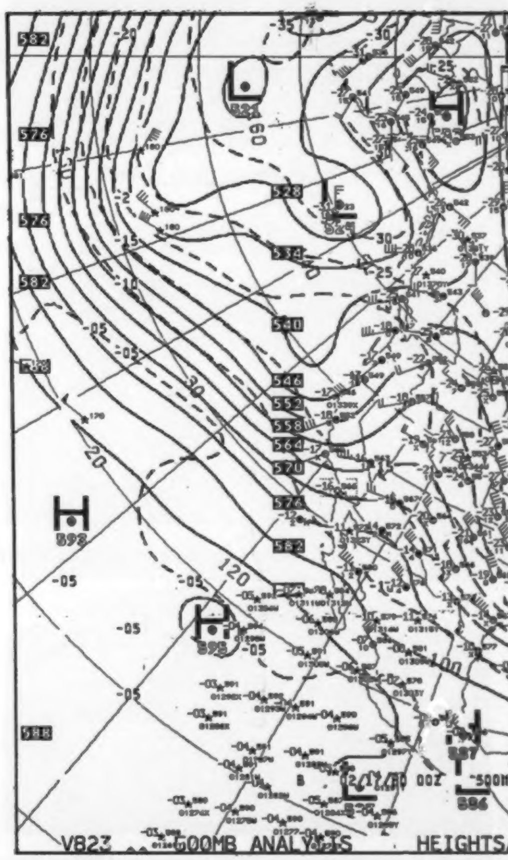


Figure 1.--Upper air 500-mb analysis at 0000 February 17, 1980.

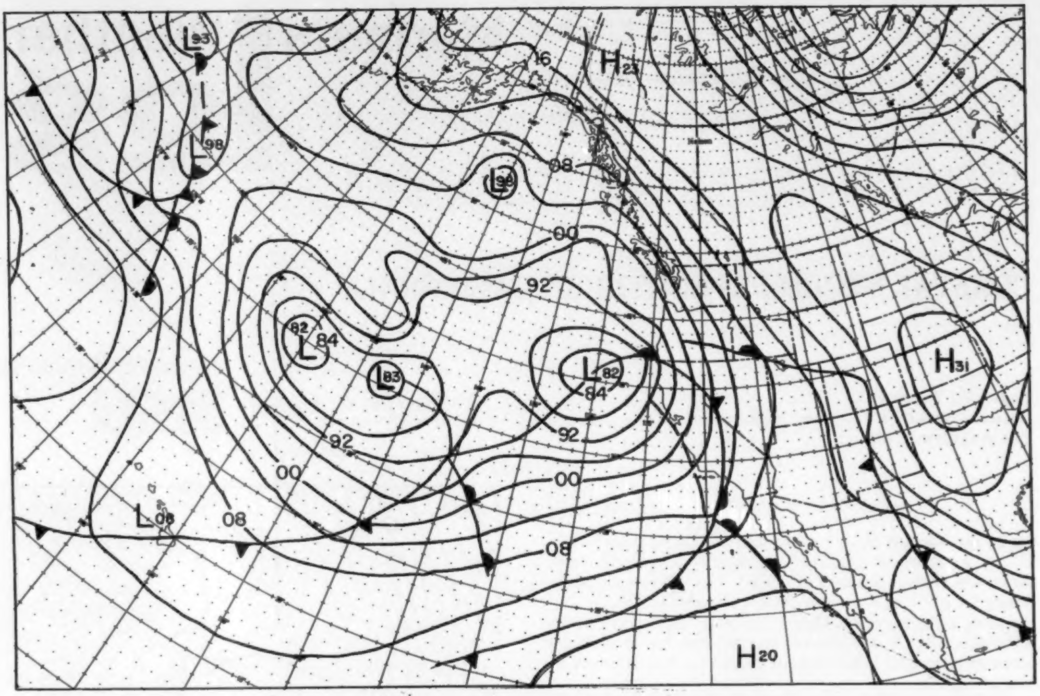


Figure 2.--Surface analysis at 0000 February 17, 1980.

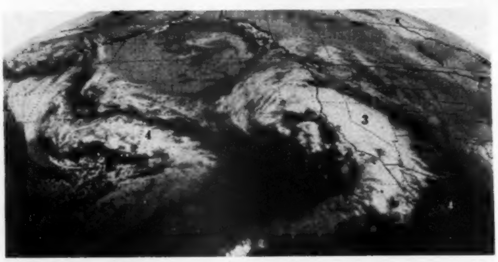


Figure 3.--Infrared satellite imagery at 1800 February 16, 1980.

Figure 5.--Infrared satellite imagery at 0000 on the 14th.

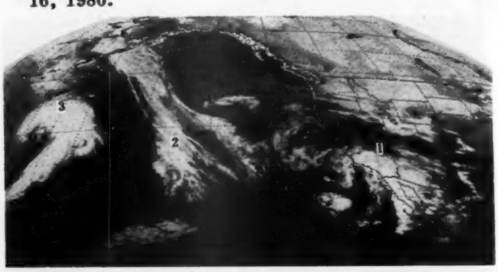


Figure 4.--Infrared satellite imagery at 1800 on the 13th. Note three comma cloud bands associated with Storm 1.

Figure 6.--Flooding at Point Mugu Naval Air Station. U.S. Army Corps of Engineers Photo.

Storm 2 extended from the Aleutians to 30°N, 145°W, while Storm 3 was approaching 160°W. By the 14th the tropical feederband, which was over Hawaii on the previous day (see fig. 4) had been enhanced and pushed rapidly to Southern California by Storm 2 (fig. 5). This picture also shows that Storm 3 had developed further with an extensive cloud mass centered near 33°N, 154°W.

Figure 3 was taken as Storm 3 was lashing Southern California with heavy rain, thunderstorms, and strong winds on the 16th. By this time, the combined effects of 3 previous wet days and the heavy rain on the 16th dramatically increased flash floods and mud slides. There was extensive flooding at Point Mugu Naval Air Station (fig. 6), where 3,300 of the base's 4,400 military personnel and dependents were evacuated. Flash floods, stream flooding, and mud slides damaged numerous structures in several areas of Southern California. Five to eight inches of rain in 24 hr was common in mountain and foothill areas during this storm. Heavy short-period amounts were also reported. Figure 7 shows an accumulation of about 6 in in 8 hr at Sepulveda Dam in the San Fernando Valley during the late morning and afternoon of the 16th. A resident of Topanga Canyon, just northwest of Los Angeles, reported about 10 in rain from heavy thundershowers during the evening.

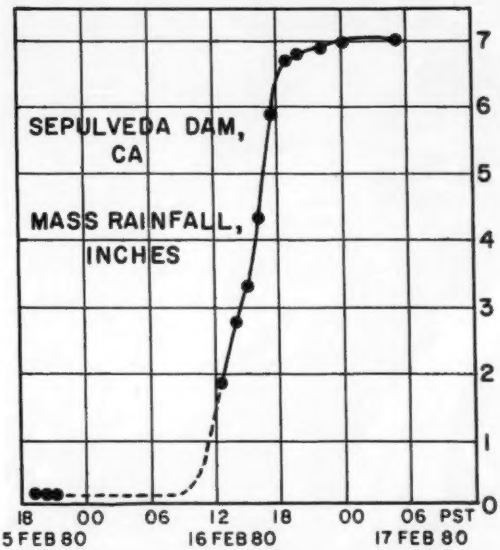


Figure 7.--Rainfall accumulation at Sepulveda Dam, February 16, 1980. Graph by Dr. Charles Pyke, U.S. Army Corps of Engineers.

Figure 8 is a visible satellite image at 2315 on the 17th. Comparing it with figure 3 shows the rapid eastward movement of Storm 4 over a 29-hr period. A new surge of heavy rain began during the afternoon of the 17th, prompting issuance of a new Flash Flood Watch. Storm 4 dumped up to 4.5 in of rain on already saturated ground, compounding previous damage, and causing

Figure 8.--Visual satellite imagery at 2300 February 17, 1980.

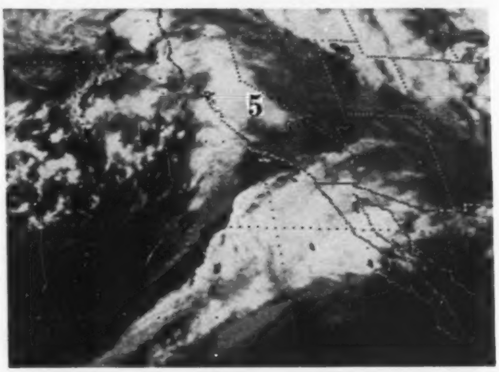


Figure 9.--Infrared satellite imagery at 0600 February 19, 1980. Storm 5 is merging with tail of Storm 4.

new flooding and mud slides.

Figure 8 shows the beginnings of Storm 5 near 30°N, 150°W. This storm moved eastward at about 45 kn before striking California on the 18th and 19th. Figure 9 shows Storm 5 beginning to merge with a wave that had formed on the tail of Storm 4 off the Baja California coast. Again, tropical moisture can be seen streaming northeastward along this wave. More flooding and mud slides occurred. Orange and San Diego counties were particularly hard hit. Flooding of the San Luis Rey River in the vicinity of Oceanside caused fatalities and

Figure 10.--Flooding vicinity of Oceanside. U.S. Army Corps of Engineers Photo.

extensive property damage and disrupted transportation (fig. 10).

Storm 5 also generated large swells as it raced toward the coast. A long fetch of west-southwesterly winds preceded the storm. A heavy surf advisory was issued on the 18th. Maximum breakers of 10 to 15 ft pounded the coast on the 19th and 20th. Erosion and damage to beach structures were widespread. The restaurant LADY ALEXANDRA, a converted passenger ship moored inside the Redondo Beach breakwater, was nearly a total loss (fig. 11). It was subsequently towed out to sea and scuttled. Figures 12, 13, and 14 illustrate the extent of damage and erosion in the Oceanside and other beach areas.

The cloud mass that eventually became Storm 6 can be seen near 35°N, 147°W, in figure 9. It weakened, then redeveloped rapidly and sped toward the coast at over 60 kn during the night of the 19th and the morning of the 20th. By afternoon of the 20th (fig. 15), heavy

Figure 11.--The LADY ALEXANDRA lies on her side after high waves and strong currents damaged the ship and pier. Wide World Photo.

Figure 12.--Oceanside wave damage caused by Storm 5. U.S. Army Corps of Engineers Photo.

rain was again disrupting the lives of beleaguered Southern Californians. Heaviest rains were in the San Diego County mountains, where up to 5.5 in fell during the storm's passage.

This was the last storm of the series. A ridge of high pressure, seen bending the jetstream clouds northward along 135°W in figure 15, moved eastward and deflected subsequent storms toward Northern California and the Pacific Northwest.

Total rainfall for the 9 storm days was 5 to 15 in near the coast and 15 to 30 in over the foothill and

Figure 14.--Wreckage of beach front homes along Malibu Beach. Wide World Photo.

Figure 13.--Beach erosion near Oceanside. U.S. Army Corps of Engineers Photo.

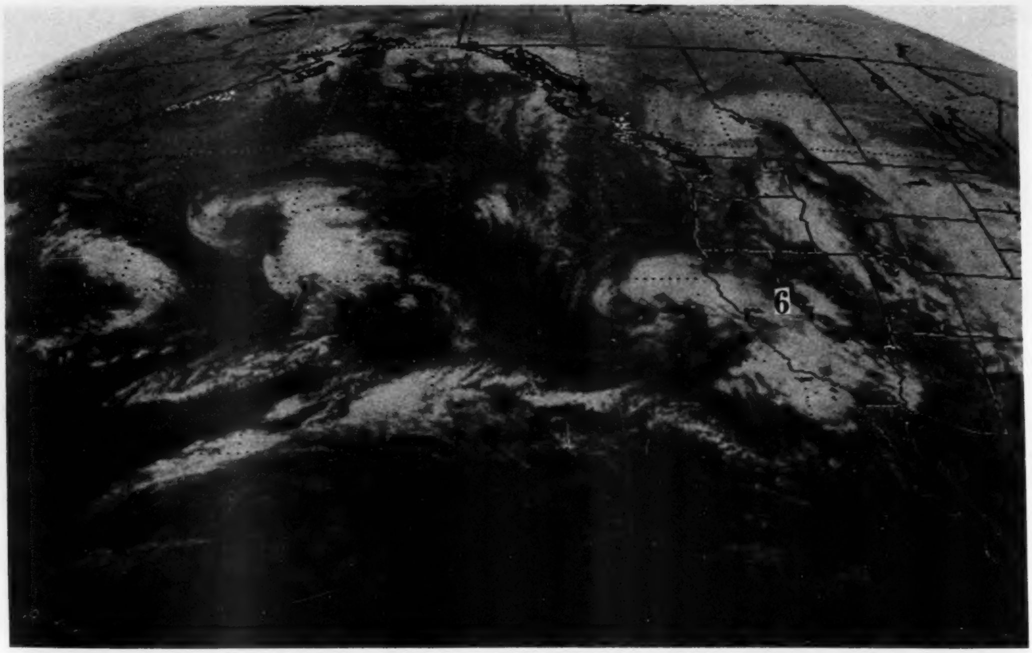


Figure 15.--Infrared satellite imagery afternoon of the 20th. Last storm of series over Southern California as ridge builds near 135°W.

mountain areas. Rainfall for the 12-mo period July 1979 through June 1980 was one of the heaviest since records began in 1877. Nearly 27 in had fallen by the end of May compared to a normal of 14 in. The 1979-80 season also marked the third consecutive season of much above-normal precipitation. About 80 in of rain was recorded in downtown Los Angeles during the past three seasons, nearly twice the normal amount. They were the three wettest consecutive seasons on record. This period sharply contrasts with the previous two seasons, 1975-76 and 1976-77. These were drought years in California, when Los Angeles received only 70 percent of normal rainfall.

The record-setting three wet seasons caused severe flooding along the shores of Lake Elsinore, a retirement and tourist community in the San Bernardino Valley southeast of Los Angeles (fig. 16). The lake normally drops significantly during the summer and fall months. However, prolonged high run-off from the previous wet years set the stage for the lake to rise about 30 ft above its normal level during the February 1980 rains. Many homes and businesses along and near the shore were flooded.

Figure 16.--Flooding at Lake Elsinore. U.S. Army Corps of Engineers Photo.

SUMMARY

In addition to 18 storm-related deaths, about 150 persons were injured. More than 100 homes were destroyed, 1,500 were severely damaged, and 350 businesses had major structural damage. The President declared seven of the eight Southern California counties major disaster areas.

During the heavy rain period, the Los Angeles Weather Service Forecast Office issued 48 Flash Flood Watches, Warnings, and Special Weather Statements. About 115 live and taped interviews were provided to the news media.

REFERENCE

National Weather Service, "The Southern California Rains of February 13-21, 1980," NWS Forecast Office, Los Angeles, March 1980.

Mariners Weather Log

UNUSUAL WINTER STORM, HAWAII

Hans E. Rosendal
Forecast Office
National Weather Service, NOAA
Honolulu, Hawaii

From January 8 to 11, 1980, the Hawaiian Islands experienced some of the most severe weather from a winter storm in recent years. Even though rainfall was over 20 in in some places, the most noteworthy and damaging aspects of this stormy episode were the destructive winds which occasionally reached storm force. Damage to crops and property is estimated between $25 and $35 million. There were seven storm-related fatalities.

The 1979-80 winter season across the North Pacific was characterized by the westerly jet stream aloft being quite far south of its normal position over the eastern half of the ocean from near Hawaii to the U.S. West Coast (fig. 17). Consequently, the surface westerlies were also well south of their usual latitude belt, and the normal trade winds over the Hawaiian Islands were absent during much of the winter season. Other manifestations of the unusual general circulation pat-

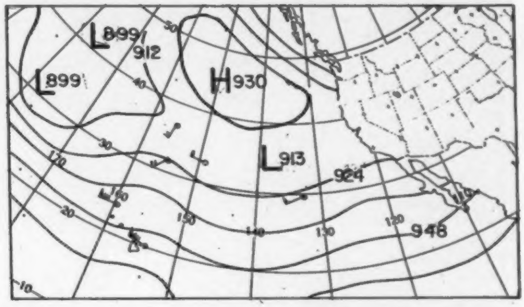


Figure 17.--Jet stream is well south of its normal position as seen on this 300-mb chart at 0000 January 8, 1980.

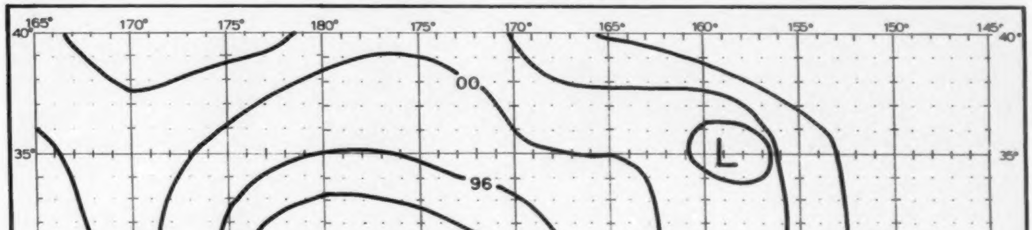


Figure 18.--At 0000 January 8 surface chart shows 984-mb cyclone moving eastward along the 30th parallel.

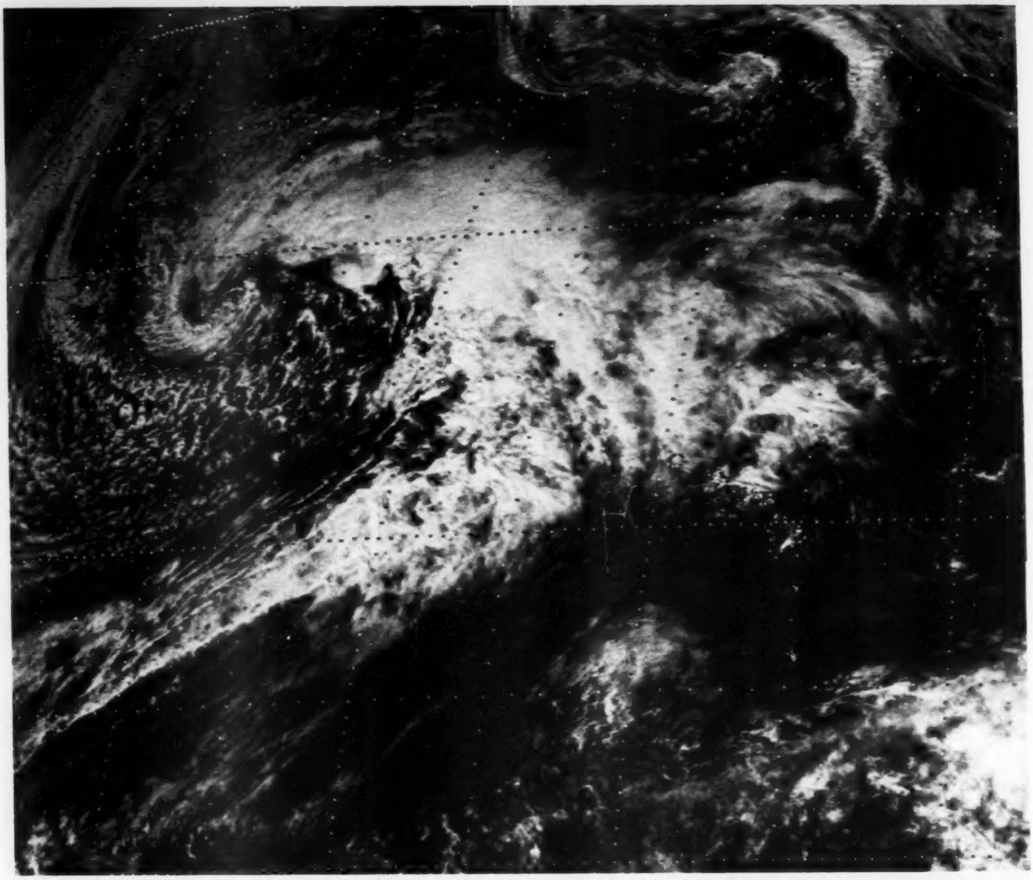


Figure 19.--Satellite catches storm winding up late on the 7th as it crosses the date line for its frontal attack on the Hawaiian Islands.

tern over the North Pacific were the prolonged heavy rains over Southern California in mid-February and the persistent blocking high pressure during much of the winter over Alaska and the Bering Sea area.

Two separate low-pressure systems were involved during the January 8 to 11 episode over the Hawaiian Islands. At 1200 on January 7 an eastward-moving low-pressure system crossed the date line near Midway Island. This LOW deepened to near 975 mb north of Hawaii on the 8th while tracking eastward along 30°N (figs. 18 and 19). A value of 975 mb may not seem low to a mariner used to LOWs as deep as 950 mb along the northern shipping lanes in winter, but at 30°N where the subtropical high-pressure system usually dominates, it is a quite respectable LOW.

The low-pressure system became nearly stationary north of Hawaii on the 9th and then commenced drifting slowly northward early on the 10th. Thus, the winds temporarily diminished over the islands, while the weather partially cleared except over Maui and the Big Island where showers persisted (fig. 20). Meanwhile, a secondary low-pressure system appeared near Midway Island and moved rapidly southeastward and eastward toward the islands within the huge vortex of the primary low-pressure system. This reinforcement caused our winds to increase again as heavy showers and thunderstorms redeveloped. Finally, on the 11th the weather improved once more as a frontal band pushed southeastward through the Islands. High westerly sea swells continued to batter the western shores of all islands for another 24 to 48 hr. The most damaging surf occurred along the Kona coast of the Big Island, where many homes suffered extensive damage. Some damage also occurred to expensive pleasure craft at anchorages and harbors along the lee shores of both Maui and the Big Island. Observations from merchant ships operating west of the islands were extremely important to the local forecaster. Mariners' estimates of swell height, period, and direction of travel were critical in issuing timely warnings for the affected shores.

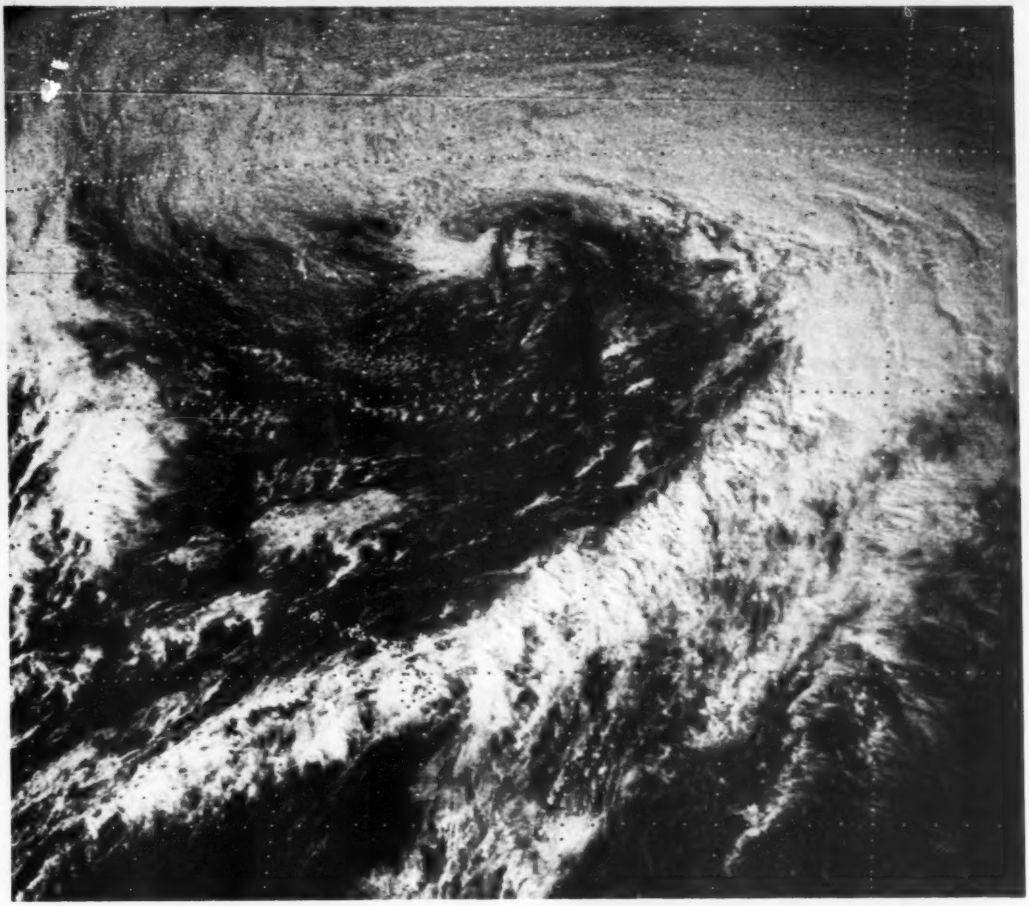


Figure 20.--Storm is located north of the Islands early on the 10th. Its trailing cold front is still affecting Maui and the Big Island.

There was no damage to shipping reported in the area. Open ocean winds were generally in the 35- to 45-kn range during the peak of the storm. Interisland barge traffic was suspended during this period, and loading and unloading operations at Honolulu, Lihue, and Kahului harbors were hampered by the heavy rains and high winds. Fishing vessels stayed in port or moved to sheltered areas. The mountainous topography of the islands produced tremendous local variations in winds and weather. In a storm of this type the winds blow from westerly or southwesterly directions, which are opposite to the usual trade wind direction. This places heavy stress on trees, vegetation, buildings, and utility wires which are used to the northeasterly trade wind direction.

Behaving much like a car, winds will accelerate when blowing downhill and slow down when climbing a hill. The basic laws of physics governing transformations between potential and kinetic energy are involved. Strongest winds across the islands were therefore over the normally windward slopes which usually experience gentle northeasterlies during trade wind conditions. Extensive damage to dwellings occurred in these areas along with interruptions in the power supply which locally lasted several days. Several short-track tornadoes associated with thundershowers also caused damage to a number of homes and ruptured a major transmission line. A cargo plane crashed at the Honolulu airport killing two crewmembers.

All in all, thanks in no small measure to weather reports from ships crossing the Pacific, the Weather Forecast Office in Honolulu was able to give adequate warnings of the storm and its associated winds, heavy rain, and damaging surf. Even in today's modern world with satellites and high-flying aircraft, the forecaster is in need of ground truth and he still depends on the 6-hr reports from ships at sea. Thanks for these reports and please keep them coming.

WESTERN NORTH PACIFIC TYPHOONS, 1979

Extracted from Annual Typhoon Report, 1979, U.S. Fleet Weather Central, Joint Typhoon Warning Center, Guam, Mariana Islands.

The western North Pacific experienced a below-normal year of tropical-cyclone activity with 28 cyclones during 1979 (table 1). By comparison, 1978 was a nearly normal year with 32 cyclones, and 1977 was a near record-low year with 21 cyclones. Five significant tropical cyclones never developed beyond the tropical-depression stage, and nine developed into tropical storms. Of the 14 cyclones that developed to typhoon stage, only 4 reached the 130-kn intensity necessary to be classified as a supertyphoon. This season, beginning with typhoon Bess, tropical cyclones attaining tropical-storm strength or greater were assigned names on an alternating male/female basis. This change was a result of the 1979 Tropical Cyclone Conference. Each tropical cyclone's maximum surface wind (kn) and minimum observed sea-level pressure (mb) were obtained from best estimates of all available data. The distance traveled (mi) was calculated from the Joint Typhoon Warning Center's (JTWC) official best track.

Tables 2 and 3 provide further information on the monthly distribution of tropical cyclones. Even though there were four fewer cyclones this season compared to last season, there were 18 more warning days for a total of 149. There were 38 warning days with two cyclones and 5 warning days with three or more cyclones.

The cyclone tracks are shown in figures 21, 22, and 23. The tracks are indicated from first detection until dissipation or becoming extratropical. In tables 2 and 3 the storms are credited in the month that the first warning was issued. Numbers for past years' tables may disagree with these tables, as those tables indicated month of first detection. Maximum winds are estimates of sustained windspeeds for a 1-min-averaging period.

Individual typhoons are described in the following narratives. Times are GMT unless otherwise indicated. Tropical-storm summaries may be found in the "Smooth Log" of the appropriate issue of the Mariners Weather Log.

TYPHOON ALICE

Typhoon Alice, the first tropical cyclone of the 1979 season, was actually first sighted as a tropical distur-

Table 1.--Western North Pacific significant tropical cyclones, 1979

CYCLONE	TYPE	NAME	PERIOD OF WARNING	CALENDAR DAYS OF WARNING	MAX SFC WIND	MIN OBS SLP	NUMBER OF WARNINGS	DISTANCE TRAVELLED
01	TY	ALICE	01 JAN-14 JAN	14	110	930	51	2597
02	TY	BESS	20 MAR-25 MAR	6	90	958	21	1804
03	TY	CECIL	11 APR-20 APR	10	80	965	40	2535
04	TS	DOT	10 MAY-16 MAY	7	40	984	24	2876
05	TD	TD-05	23 MAY-24 MAY	2	30	998	6	2170
06	TY	ELLIS	01 JUL-06 JUL	6	85	955	22	1612
07	TS	FAYE	01 JUL-06 JUL	6	40	998	20	1837
08	TD	TD-08	24 JUL-25 JUL	2	20	1004	5	1264
09	ST	HOPE	27 JUL-03 AUG	10	130	898	33	3928
10	TS	GORDON	26 JUL-29 JUL	4	60	980	13	1058
11	TD	TD-11	03 AUG-06 AUG	4	25	997	14	1088
12	TY	IRVING	09 AUG-18 AUG	10	90	954	38	2732
13	ST	JUDY	16 AUG-26 AUG	11	135	887	39	2502
14	TD	TD-14	18 AUG-20 AUG	3	20	1006	9	605
15	TS	KEN	01 SEP-04 SEP	5	60	985	13	1418
16	TY	LOLA	02 SEP-08 SEP	7	90	950	23	1298
17	TY	MAC	15 SEP-24 SEP	10	70	984	35	1831
18	TS	NANCY	19 SEP-22 SEP	4	45	993	14	528
19	TY	OWEN	22 SEP-01 OCT	10	110	918	37	2151
20	TS	PAMELA	25 SEP-26 SEP	3	45	1002	6	984
21	TS	ROGER	03 OCT-07 OCT	6	45	985	16	1920
22	TY	SARAH	04 OCT-15 OCT	12	110	929	43	1194
23	ST	TIP	05 OCT-19 OCT	16	165	870	60	3972
24	ST	VERA	02 NOV-07 NOV	6	140	915	23	1868
25	TS	WAYNE	08 NOV-13 NOV	6	50	990	22	1559
26	TD	TD-26	01 DEC-02 DEC	2	30	998	6	1070
27	TY	ABBY	01 DEC-14 DEC	14	110	951	52	4044
28	TS	BEN	21 DEC-23 DEC	3	60	990	10	2245
			1979 TOTALS	149*			695	

*OVERLAPPING DAYS INCLUDED ONLY ONCE IN SUM.

Table 2.--Frequency of typhoons by month and year

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
AVERAGE (1945-58)	0.4	0.1	0.3	0.4	0.7	1.1	2.0	2.9	3.2	2.4	2.0	0.9	16.3
1959	0	0	0	1	0	0	1	5	3	3	2	2	17
1960	0	0	0	1	0	2	2	8	0	4	1	1	19
1961	0	0	1	0	2	1	3	3	5	3	1	1	20
1962	0	0	0	1	2	0	5	7	2	4	3	0	24
1963	0	0	0	1	1	2	3	3	3	4	0	2	19
1964	0	0	0	0	2	2	6	3	5	3	4	1	26
1965	1	0	0	1	2	2	4	3	5	2	1	0	21
1966	0	0	0	1	2	1	3	6	4	2	0	1	20
1967	0	0	1	1	0	1	3	4	4	3	3	0	20
1968	0	0	0	1	1	1	1	4	3	5	4	0	20
1969	1	0	0	1	0	0	2	3	2	3	1	0	13
1970	0	1	0	0	0	1	0	4	2	3	1	0	12
1971	0	0	0	3	1	2	6	3	5	3	1	0	24
1972	1	0	0	0	1	1	4	4	3	4	2	2	22
1973	0	0	0	0	0	0	4	2	2	4	0	0	12
1974	0	0	0	0	1	2	1	2	3	4	2	0	14
1975	1	0	0	0	0	0	1	3	4	3	2	0	15
1976	1	0	0	1	2	2	2	1	4	1	1	0	15
1977	0	0	0	0	0	0	3	0	2	3	2	1	11
1978	0	0	0	1	0	0	3	2	4	3	2	0	15
1979	1	0	1	1	0	0	2	2	2	2	1	1	13
AVERAGE (1959-78)	0.25	0.05	0.10	0.70	0.85	0.95	2.85	3,55	3.25	3.20	1.65	0.55	17.95

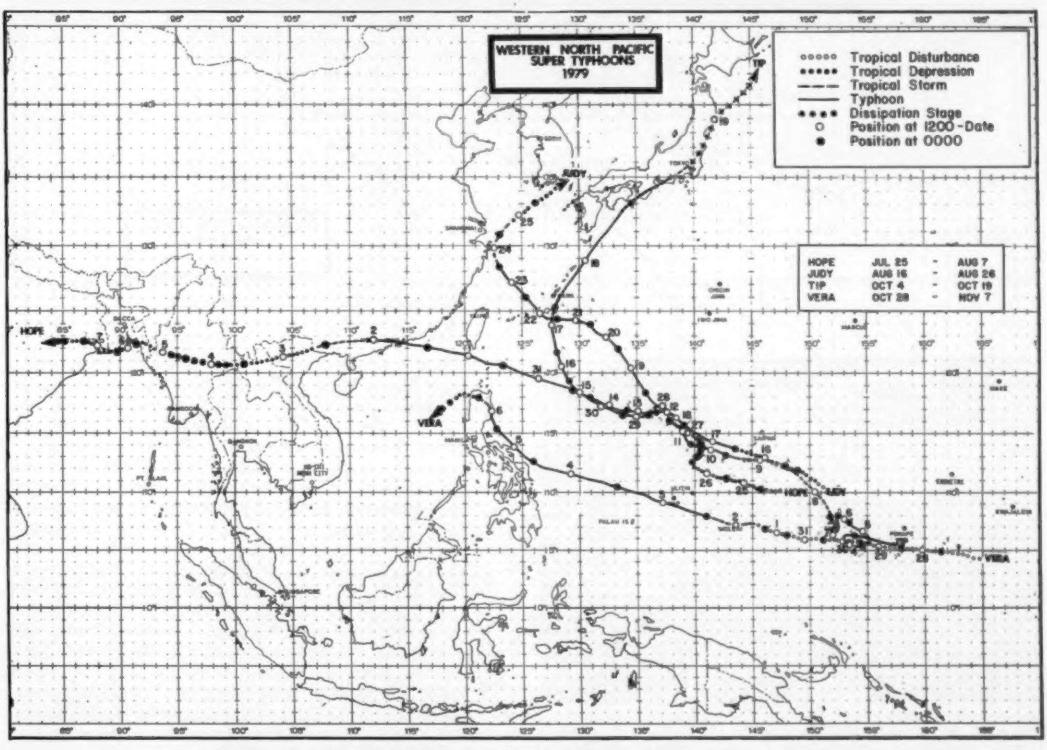


Figure 21.--Tracks of western North Pacific supertyphoons, 1979.

bance on December 27, 1978. The potential for development was considered poor as it was so near the Equator. On January 1, 1979, the disturbance accelerated to higher latitudes and was named Alice. She meandered through the Marshall Islands, causing much damage as an upper air, short-wave trough temporarily steered her on a northeasterly track. On the 4th she turned back on a normal westerly track.

Table 3. --Frequency of tropical storms and typhoons by month and year

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
AVERAGE (1945-58)	0.4	0.1	0.4	0.5	0.8	1.3	3.0	3.9	4.1	3.3	2.7	1.1	21.6
1959	0	1	1	1	0	0	3	6	6	4	2	2	26
1960	0	0	0	1	1	3	3	10	3	4	1	1	27
1961	1	1	1	1	3	2	5	4	6	5	1	1	31
1962	0	1	0	1	2	0	6	7	3	5	3	2	30
1963	0	0	0	1	1	3	4	3	5	5	0	3	25
1964	0	0	0	0	2	2	7	9	7	6	6	1	40
1965	2	2	1	1	2	3	5	6	7	2	2	1	34
1966	0	0	0	1	2	1	5	8	7	3	2	1	30
1967	1	0	2	1	1	1	6	8	7	4	3	1	35
1968	0	0	0	1	1	1	3	8	3	6	4	0	27
1969	1	0	1	1	0	0	3	4	3	3	2	1	19
1970	0	1	0	0	0	2	2	6	4	5	4	0	24
1971	1	0	1	3	4	2	8	4	6	4	2	0	35
1972	1	0	0	0	1	3	6	5	4	5	2	3	30
1973	0	0	0	0	0	0	7	5	2	4	3	0	21
1974	1	0	1	1	1	4	4	5	5	4	4	2	32
1975	1	0	0	0	0	0	2	4	5	5	3	0	20
1976	1	1	0	2	2	2	4	4	5	1	1	2	25
1977	0	0	1	0	0	1	4	1	5	4	2	1	19
1978	1	0	0	1	0	3	4	7	5	4	3	0	28
1979	1	0	1	1	1	0	4	2	6	3	2	2	23
AVERAGE (1959-78)	0.55	0.35	0.45	0.85	1.15	1.65	4.55	5.70	4.90	4.15	2.50	1.10	27.90

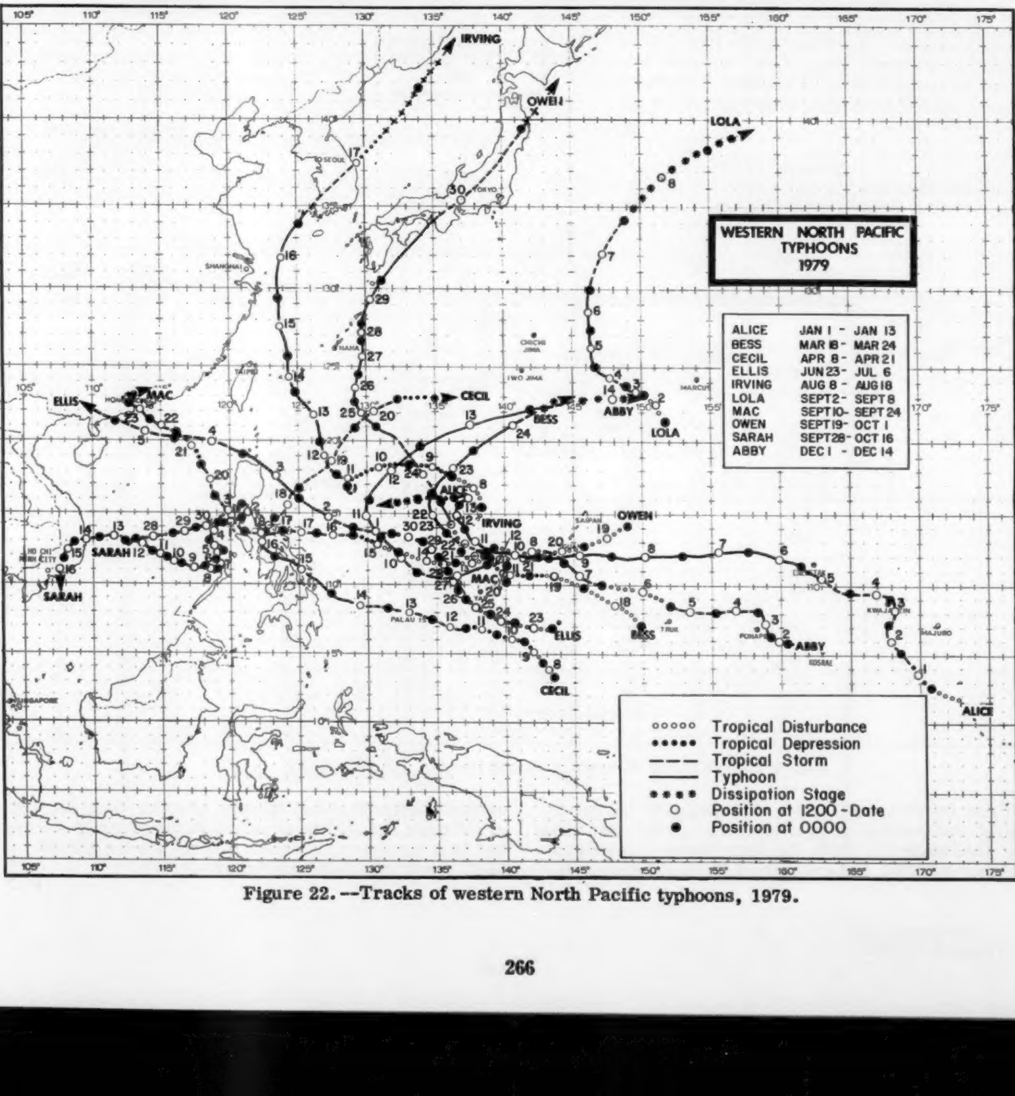


Figure 22. --Tracks of western North Pacific typhoons, 1979.

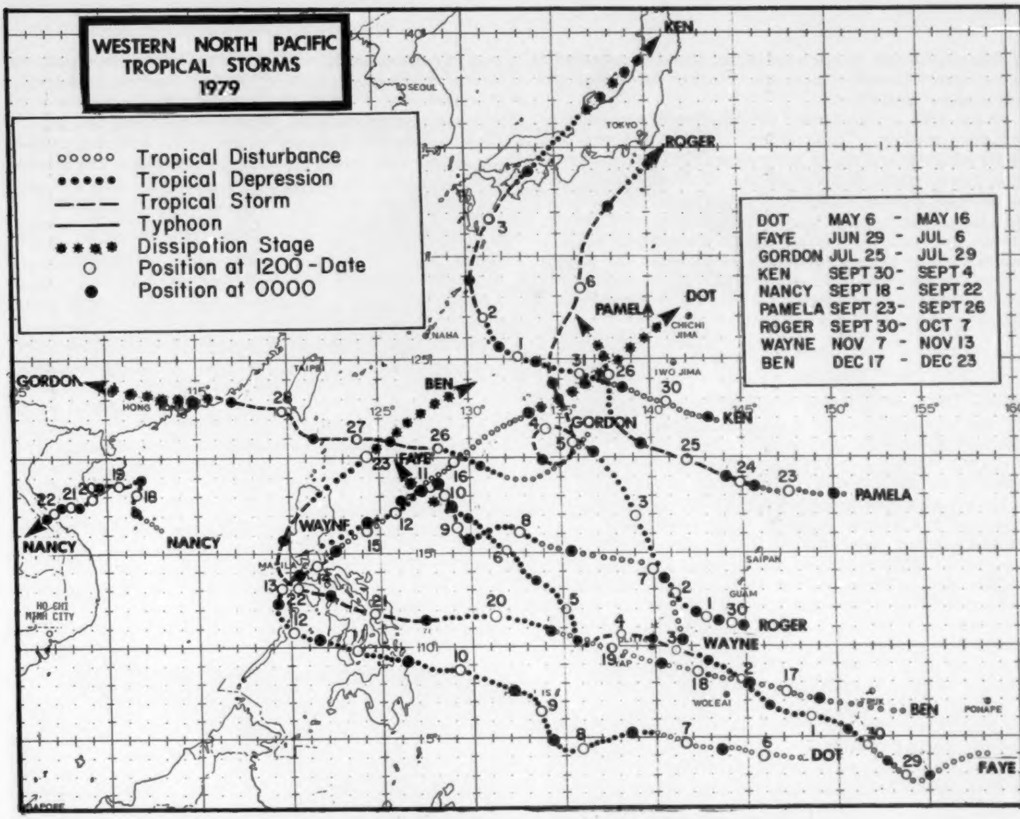


Figure 23.--Tracks of western North Pacific tropical cyclones, 1979.

From the 6th to the 11th, Alice traveled due west. On the 8th she attained 110-kn intensity and simultaneously accelerated to a speed of 14 kn whereupon she began weakening slowly.

During the 9th, Alice began an unexpected northward movement and showed further weakening. Postanalysis of low-level synoptic data and satellite imagery (fig. 24) indicated that an approaching frontal shear-line was the responsible agent. The shear-line began interacting with Alice while she was southeast of Guam. As Alice neared Guam, radar data from Andersen Air Force Base and aircraft data indicated that Alice's previously well-defined wall cloud had become larger and somewhat less organized. Cooler, drier air north of the shear-line probably was responsible for this weakening trend. A weakness in the subtropical ridge vertically above the shear-line apparently allowed for Alice's northward deviation.

The most unusual portion of Alice's track occurred during the final 3 days of Alice's life. Based on interpretation of computer prognoses, the subtropical ridge was expected to persist and maintain Alice in the easterlies. As a result, the JTWC forecasts indicated a westward movement until 0000 on the 12th, 18 hr after Alice had actually begun tracking northwestward. The subtropical ridge weakened in response to a long-wave

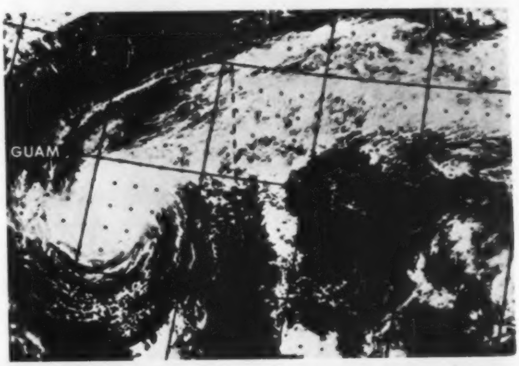


Figure 24.--Typhoon Alice merging with the trailing end of a frontal shear-line, at 0054, on January 9, 1979. (DMSP imagery)

trough deepening over eastern Asia. Easterly steering currents in Alice's vicinity diminished and veered in direction, permitting a more northward track. Alice reached a secondary intensity maximum of 100 kn dur-

ing this period due to her slowing in speed of movement, the increased absolute vorticity of higher latitudes, and good outflow aloft.

By the 13th, Alice turned northeastward and began weakening rapidly. The subtropical ridge was now completely severed and upper air westerlies were shearing Alice significantly in the vertical. Close proximity of yet another frontal shear-line contributed to further weakening. The biggest surprise, however, came when Alice's low-level circulation turned almost 180° back toward the west at about 1200 on the 13th under the influence of strong, low-level easterlies. Alice weakened rapidly in the strong, vertical-shear environment and dissipated during the next 12 hr.

TYPHOON BESS

Since 1959, only three typhoons have developed over the western Pacific in March. Of these, only Bess developed in the last decade with Tess developing in 1961 and Sally in 1967. Tropical-cyclone development in March is usually inhibited by a southward adjustment in the subtropical ridge axis. Although not recognized in advance, typhoon Bess' development paralleled that of typhoon Tess, which developed in the eastern Caroline Islands and reached tropical-depression strength near Woleai Atoll. Continuing northwestward between Guam and Yap, both recurved northward near 135°E before dissipating north of 20°N under the influence of a strong vertical shear.

Synoptic data at 0000 on March 16 suggested the existence of a weak surface circulation near 3°N, 152.5°E, at the base of a wave in the easterly flow. Satellite imagery at 0119 showed an ill-defined area of convection near the surface circulation. By 1109 increased upper level organization suggested development of a weak 200-mb anticyclone (fig. 25). Increased curvature in the midlevel convective cloud pattern hinted at the possibility of tropical cyclone formation. Continuing to pulsate, the suspect area presented a curious, but intensified, upper level convective pattern on satellite imagery on the 17th. Synoptic analysis on the 18th indicated that, in addition to the circulation near 3.5°N, 147.5°E, a secondary LOW had developed on the slow-moving wave axis near 7.1°N, 150°E, and that the earlier ill-defined convection had been associated with these two circulations. As this secondary LOW tracked northward up the wave axis, increased cyclonic shear between strong easterly flow north of the wave and weak equatorial westerlies south of the wave caused the northern circulation to become the dominant center as the initial LOW weakened. Simultaneously, the upper level anticyclone intensified, producing an excellent outflow signature on satellite imagery. Aircraft data at 0259 on the 20th found strong enhanced easterly flow of 20 to 30 kn to the northeast, but only weak cyclonic flow to the south and east. Aircraft reports finally confirmed tropical-storm strength early on the 21st (fig. 26), 5 days after Bess was first observed.

Sea-surface temperature (SST) plays a vital role in the development and maintenance of tropical cyclones. A study indicates that tropical cyclones which move over water cooler than 26°C are less likely to intensify due to a reduction in latent heat. The study further states that tropical cyclones which develop prior to June intensify up to 10 kn after recurvature. This in-

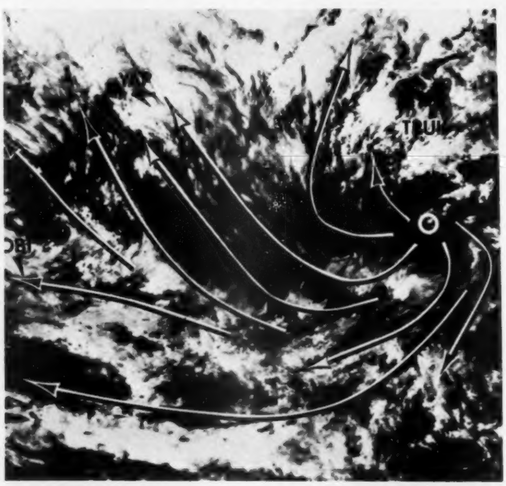


Figure 25.--Infrared imagery of very early development stage of Bess, at 1109, on March 16, 1979. Streamline pattern indicates an upper level anticyclone. A surface circulation had not yet developed. (DMSP imagery)

Figure 26.--Typhoon Bess just prior to reaching her maximum intensity of 90 kn, at 0235, on March 23, 1979. Bess displays a large elliptical eye with strong cirrus outflow in all directions. (DMSP imagery)

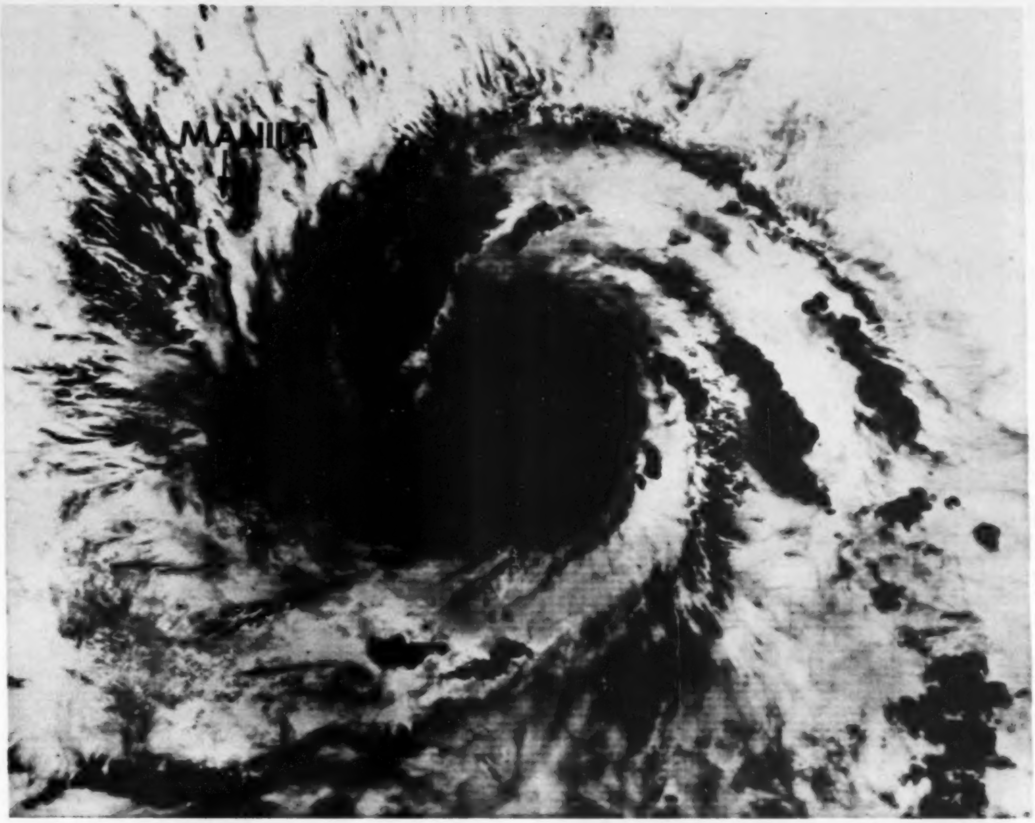


Figure 27.--Infrared imagery of typhoon Cecil 36 hr prior to recurvature with maximum sustained winds of 80 kn, at 1225, on April 15, 1979. (DMSP imagery)

tensification, if experienced, will occur within the 12 to 24 hr following recurvature. Typhoon Bess followed this recurvature pattern. The axis of recurvature was crossed at 0000 on the 23d. Slow intensification occurred over the next 18 hr with Bess reaching maximum intensity of 90 kn at 1800. She maintained 90 kn for 18 hr, then rapidly weakened and dissipated by the 25th. SST analyses during March 24 to 27 indicate that the area in which Bess weakened from 90 to 60 kn in a 6-hr period corresponds closely to the location of water cooler than 26°C. The reduction of latent heat input, coupled with increased vertical shear produced by strong westerlies aloft, literally sheared Bess apart during the final 12 to 18 hr.

TYPHOON CECIL

Typhoon Cecil, the first tropical cyclone in the northwest Pacific given a male name, generated in mid-April from an easterly wave over the Philippine Sea. Cecil was forecast very well while on a climatological west-northwestward track toward the central Philippines. Overall, postanalysis statistics showed that mean forecast errors were better than long-term averages. Nevertheless, JTWC warnings failed to forecast the crucial recurvature point in Cecil's track. Was there sufficient evidence to forecast this recurvature 24 to 48 hr in advance?

Postanalysis showed that recurvature occurred 36 hr after the 1200 April 15 best-track position. Satellite imagery (fig. 27) located Cecil just south of Samar. At this time the 500-mb subtropical ridge axis was at 17°N with a small high-pressure cell over northern Luzon. The 500-mb 36-hr prognosis maintained this ridge. Steering techniques based on the synoptic situation indicated westward movement for 72 hr. Analog techniques indicated west-northwestward movement. In fact, no objective forecast technique indicated recurvature prior to entrance into the South China Sea. The climatological average location of the 500-mb ridge axis is along 15°N over the Philippines for April, and the climatological recurvature point is 15° to 17°N. Both synoptic and climatological data indicated a west-northwestward track over the Philippines with recurvature late in the forecast period in the South China Sea as Cecil tracked to the vicinity of 15°N. Postanalysis,

however, revealed that the ridge axis east of the Philippines abruptly shifted south late on the 16th with westerly winds intruding far to the south over the South China Sea. This pattern shift caused Cecil to recurve much earlier than anticipated. Within 48 hr, Cecil was well east of Luzon. The ridge axis shift was the vital piece of information not present in any of the available prognostic tools. Thus, it appears even in postanalysis that forecasting of Cecil's recurvature 36 hr in advance was beyond the state-of-the-art capabilities.

TYPHOON ELLIS

The tropical disturbance which later became typhoon Ellis was first noted on June 25. The surface/gradient-level analysis showed that a broad monsoon trough had developed between Guam and the Philippine Islands. At upper levels, a Tropical Upper Tropospheric Trough (TUTT) was oriented northeast-southwest between the Volcano Islands and the central Philippine Islands. This TUTT allowed excellent upper level outflow to the northeast and was expected to induce intensification of the tropical disturbance southeast of the TUTT axis. However, significant development did not occur. Reconnaissance aircraft could find only a very broad surface circulation with relatively high surface pressures. The surface circulation drifted under the TUTT, and the associated convection was suppressed.

The area was closely monitored. On the 30th satellite imagery showed increased convective development, and surface data showed decreasing pressures and increasing winds. Subsequent aircraft investigation revealed a minimum sea-level pressure of 1000 mb and surface winds in excess of 35 kn. The first warning on tropical storm Ellis was issued at 0000 July 1. Ellis was in a favorable position at that time, and steady intensification occurred over the next 2 days.

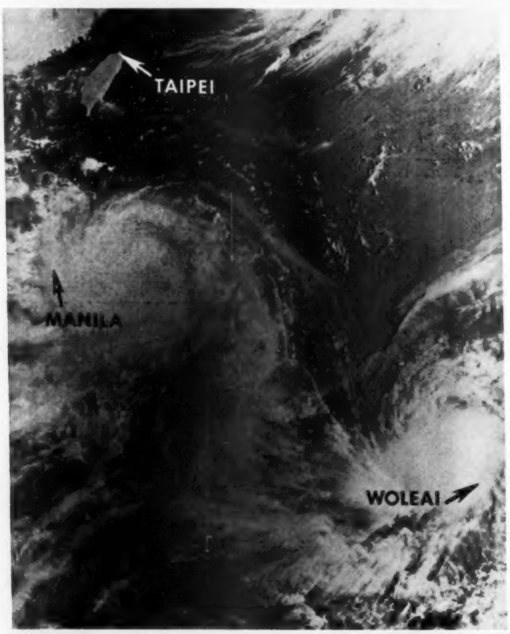


Figure 28.--Typhoon Ellis (left) at maximum intensity of 85 kn, at 2356, on July 2, 1979. Tropical storm Faye (right) is developing north of Woleai. (DMSP imagery)

For his lifetime, Ellis followed an uncomplicated, classic west-northwestward track at near climatological speeds. Postanalysis shows that Ellis moved under the influence of the east-southeasterly steering flow on the southern edge of the subtropical midtropospheric ridge. His nearly straight track was primarily because this ridge did not change in intensity or orientation during the period.

Ellis reached typhoon strength on July 2 and maximum intensity of 85 kn on the 3d (fig. 28). Continued intensification was anticipated, but a slow weakening trend was actually observed.

By the time Ellis reached the South China Sea, he had weakened to tropical-storm strength and was a completely exposed low-level circulation. With winds of 54 kn, Ellis made landfall on the Chinese coast on the 6th, 164 mi southwest of Hong Kong.

SUPERTYPHOON HOPE

The disturbance which eventually developed into the first supertyphoon of 1979 became evident on July 25 on satellite imagery as a focal point of cumulus banding. Future intensification was indicated as the disturbance was situated within an area of strong upper level diffluence associated with the southern periphery of an east-west oriented TUTT.

On the 25th and 26th the depression tracked to the west-northwest, the TUTT axis shifted northward, and strong upper level northeast flow dominated the area. The resultant shear produced by this unidirectional upper level flow displaced the convective activity to the southwest of the surface circulation. By 0600 on the 27th, the center of convective activity was displaced 120 mi southwest of the low-level circulation center. Surface analyses at this time indicated the southwest monsoonal flow was being channeled principally into tropical storm Gordon about 750 mi northwest of the depression. Further weakening was expected. Aircraft investigation on the morning of the 28th showed a surface pressure of 999 mb with 45- to 50-kn winds in the heavy convective activity to the southwest of the surface center.

By the 28th tropical storm Gordon had moved into the Luzon Straits. Due to the orographic blocking of the Philippine land mass, the majority of the strong southwest monsoonal flow was diverted into the depression. This increased low-level inflow coupled with a decreasing upper level shear resulted in a much improved vertical structure with feederband activity developing in the south. On the 29th the depression was upgraded to tropical storm Hope with 35- to 45-kn winds reported in feederband activity. By 0920 a well-defined eye with a central surface pressure of 972 mb and 65- to 70-kn surface winds were reported by aircraft. At 1200 Hope was upgraded to a typhoon.

Aircraft reconnaissance at 2031 indicated a sharp decrease in surface pressure to 961 mb with the temperature/dewpoint data correlating to an equivalent potential temperature (θ_e) of 359K. An empirically derived forecast aid that relates pressure and θ_e indicates that once the traces intersect, rapid intensification can be expected within 18 to 30 hr. The intensi-

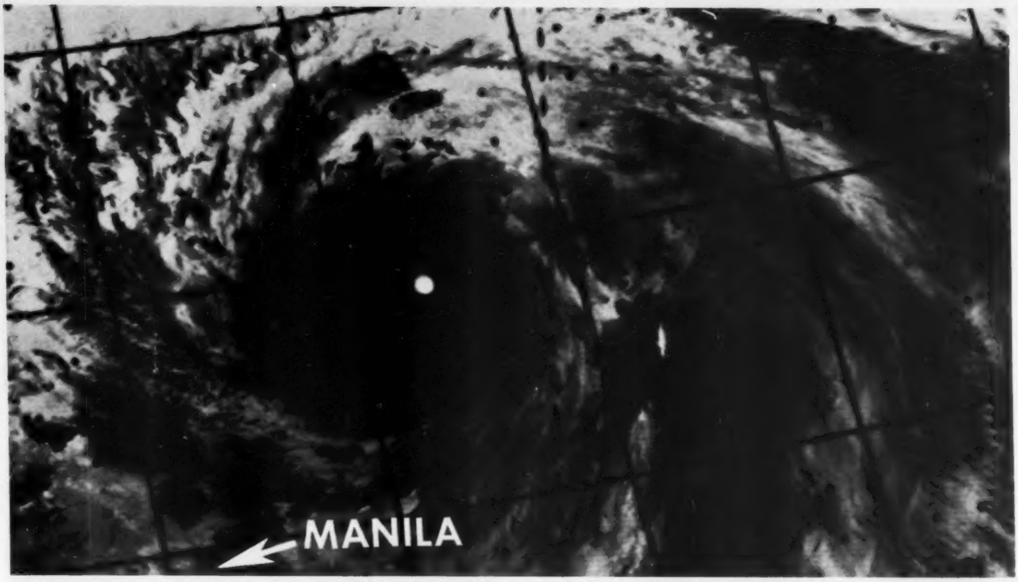


Figure 29. --Infrared imagery of Hope just after attaining supertyphoon intensity of 130 kn, at 1244, on July 31, 1979. (DMSP imagery)

fication equates to a possible mean pressure decrease of 44 mb and a mean windspeed increase of 50 to 60 kn. Typhoon Hope verified this study 36 hr after the intersection occurred; reconnaissance aircraft reported a surface pressure of 898 mb and windspeeds of 100 to 120 kn. By 1200 on the 31st, Hope attained supertyphoon intensity of 130 kn (fig. 29).

Hope entered the Luzon Straits approximately 4 days after tropical storm Gordon. Her compact wind structure and a slight weakening trend were noted as Heng Chun on the southern tip of Taiwan reported sustained winds of 40 kn with gusts to 86 kn as Hope passed 45 mi south of the station. Two persons on the Batanes Islands and one person on Taiwan were killed as a result of the torrential rainfall experienced as Hope tracked through the Luzon Straits.

Typhoon Hope made landfall less than 10 mi north of Hong Kong at 0530 August 2 (fig. 30) with maximum sustained winds of 70 kn and gusts to 110 kn. Figure 31 is a time sequence of the surface observations received

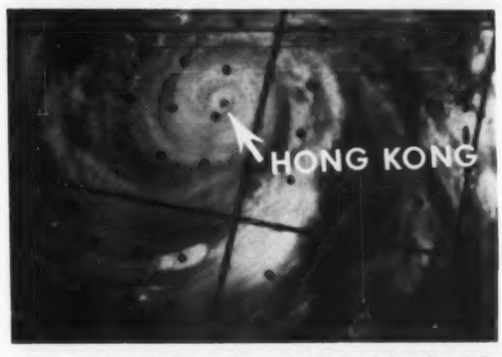


Figure 30. --Typhoon Hope at 100 kn intensity, 3 hr prior to closest point of approach to Hong Kong, at 0247, on August 2, 1979. (DMSP imagery)

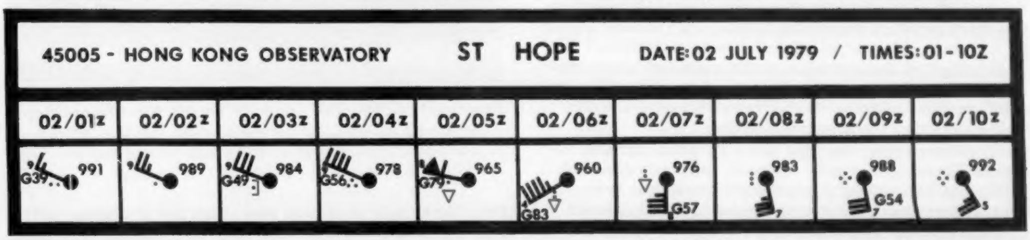


Figure 31. --Hourly surface synoptic observations from the Royal Observatory of Hong Kong during passage of typhoon Hope.

from the Royal Observatory of Hong Kong during Hope's passage. Extensive wind and rain damage, 3 deaths, and over 258 injuries were reported. In Hong Kong harbor 17 ships broke their moorings, and 8 ships collided.

After passage over Hong Kong, Hope moved into southern China and weakened. Although weakened considerably during passage over southeast Asia, Hope did maintain a satellite signature and exited into the northern Bay of Bengal 110 mi southeast of Dacca, Pakistan, on the 6th. Strengthened once again by pre-existing strong southwest monsoonal flow, Hope reintensified on the 7th with maximum sustained winds of 35 kn.

A preliminary report from the Royal Oservatory, Hong Kong on Hope can be found in the January 1980 issue.

TYPHOON IRVING

Surges in the southwest monsoon frequent the western North Pacific during the early tropical cyclone season and produce widespread convection from the Malay Peninsula to as far east as Guam. During the same period, the 500-mb monsoon trough fluctuates eastward across the South China Sea and occasionally into the Philippine Sea. By late July, an eastward extension of the midlevel monsoon trough was the main synoptic feature west of Guam. The 500-mb trough axis extended along 15°N from northern Vietnam through the central South China Sea and then eastward into a quasi-stationary low-pressure center over the Philippine Sea.

On August 7 a developing surface circulation was observed at the eastern end of the monsoon trough near 14.1°N, 137.7°E. This weak circulation tracked cyclonically around the eastern periphery of the broad 500-mb low-pressure center in the Philippine Sea. Taking on the characteristics of a monsoon depression, Irving was described in aircraft reconnaissance data received from August 9 to 11 as a weak depression with poor vertical alinement and maximum surface winds 150 to 180 mi west of the surface center. Ship synoptic data during this period indicated that 25- to 35-kn winds extended outward 120 mi south of the surface center.

By the 11th the monsoon surge had weakened and receded westward, leaving a cut-off 500-mb LOW over the Philippine Sea in the vicinity of Irving's surface circulation. The vertical alinement between the surface and the 500-mb center improved, and Irving intensified to a tropical storm. Simultaneously, a break developed in the 500-mb subtropical ridge to the north, and Irving tracked north-northwestward towards the Ryukyu Islands while intensifying to typhoon strength. Strengthening of the 500-mb ridge southeast of Japan caused typhoon Irving to track over the western East China Sea and accelerate north-northeastward across Korea before merging with an extratropical frontal boundary north of Japan (fig. 32).

Aircraft and synoptic data between the 9th and the 12th indicated that Irving's maximum wind band actually existed 150 to 200 mi west of the large, calm-wind surface center. Irving never became a tight, well-developed tropical cyclone (fig. 33).

Typhoon Irving was the first tropical cyclone to strike Korea this year. Rapidly weakening as he made landfall, Irving spared southern Korea from the destructive typhoon-force winds he had maintained through most of the East China Sea. Korea, however, did receive torrential rains which produced widespread flooding. The hardest hit area was the island of Cheju Do, where 4.3 in of rain was reported at Cheju. Official estimates reported 150 dead or missing, 1,000 to 2,000 homeless, and approximately $10 to $20 million damage to food and agriculture. Some 30 fishing and

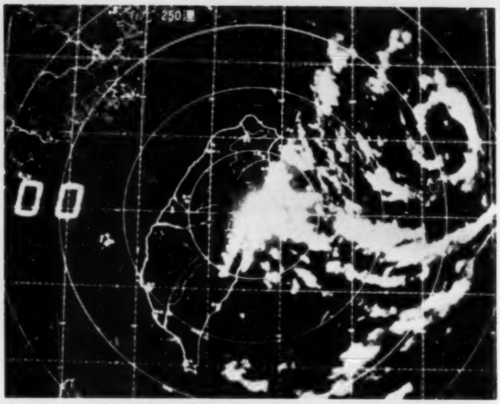


Figure 32.--Typhoon Irving as seen by the radar at Haulien, Taiwan. Irving tracked north-northwestward across the southern Ryukyu Islands and was accurately tracked by eight radar sites, at 1700, on August 14, 1979. (Photograph courtesy of the Central Weather Bureau, Taipei, Taiwan)

Figure 33.--Although typhoon Irving did not develop according to intensification studies, Irving did possess good feederband activity and cirrus outflow, at 0228, on August 14, 1979. (DMSP imagery)

other small vessels, many of which were anchored in Gamchun Bay near Pusan, were severely damaged by collision, grounding, and capsizing.

SUPERTYPHOON JUDY

Of all the typhoons of 1979, Judy's significance was only surpassed by supertyphoon Tip. Judy eventually developed into the year's second supertyphoon, but more importantly, she served as a reminder of how rapidly a minor tropical disturbance can develop into a dangerous tropical cyclone.

Surface synoptic data from the beginning to the middle of August showed that the area south and east of Guam was fairly inactive. By August 15, however, synoptic and satellite data revealed a tropical disturbance about 120 mi east-northeast of Truk, which was eventually to become typhoon Judy. No significant pressure falls were observed over the area as the disturbance drifted slowly west-northwestward.

Rapid intensification was not expected, but at 1635 on August 16, less than 10 hr after an aircraft investigation, weather radar at Andersen Air Force Base, Guam, located a well-defined circulation center moving west-northwest toward Guam at 15 kn. The disturbance continued tracking toward Guam and at 1800 the center passed over the Naval Oceanography Command Center on Nimitz Hill (fig. 34), which reported a mean sea-level pressure of 1001 mb and a wind gust of 51 kn. Based on this firsthand information, JTWC issued the first warning on tropical storm Judy at 1900.

Judy intensified steadily while following a nearly climatological west-northwestward track at 10 to 12 kn for the next 24 hr. She reached typhoon strength at

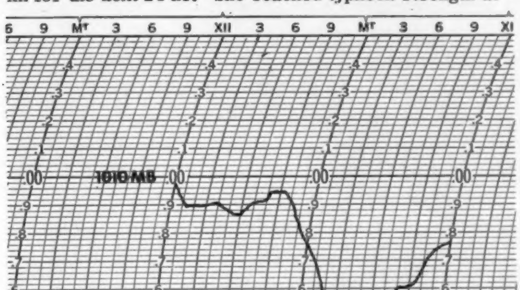


Figure 34.--Microbarograph trace recorded at Guam during the passage of tropical depression 13 (Judy) at about 1800, on August 16, 1979.

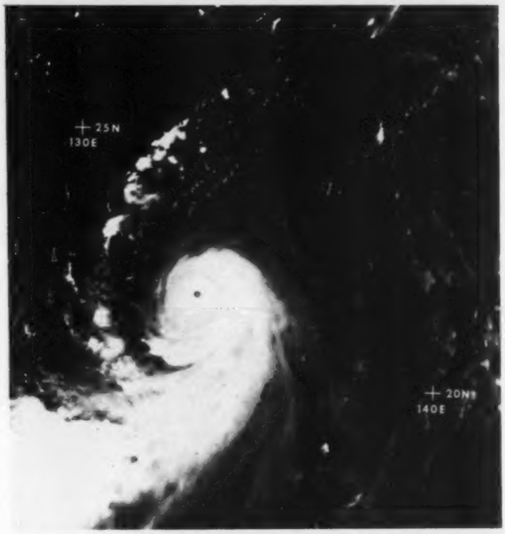


Figure 35.--Judy as a supertyphoon, at 0219, on August 20, 1979. (DMSP imagery)

approximately 0300 on the 18th. During the next 36 hr after reaching typhoon strength, Judy's central pressure dropped 69 mb, and she attained supertyphoon intensity by 0000 on the 20th. Her lowest central pressure of 887 mb was measured by reconnaissance aircraft at 2145 on the 19th. Three distinct, concentric wall clouds were also noted at that time (fig. 35). Supertyphoon intensity was maintained until 1500 on the 20th, with gradual weakening thereafter. Judy passed south of Okinawa before beginning to recurve into the East China Sea.

A rapidly intensifying ridge was expected to drive Judy into the Asian mainland south of Shanghai, but just off the Chinese coast she recurved to the northeast. As Judy recurved, she was downgraded to tropical-storm strength, based on land synoptic data. Transition to an extratropical system occurred at 1200 on the 26th, while Judy passed through the Korea Strait.

Judy was still relatively weak while passing over Guam, and damage there was insignificant. Damage to Okinawa was also minimal, even though sustained winds of 40 kn were experienced for 28 hr. Southern Korea did not fare as well; 111 people were killed, over 8,000 homes were inundated, 57 vessels were destroyed, and many thousands of acres of crops were ruined by Judy's torrential rains and strong winds.

TYPHOON LOLA

Tropical storm Ken and typhoon Lola developed almost concurrently. Satellite imagery on September 1 showed a number of disturbances organized into a line of convection from north of Kadena to south of Marcus. Ken developed from a disturbance just east of Kadena. At this same time, the disturbance which developed into Lola was south of Marcus and appeared quite weak. The largest and most menacing disturbance northwest

of Guam did not develop.

During the next 48 hr, the tropical upper tropospheric trough deepened southwestward over the middle disturbance and suppressed its convection. At the same time, it divided the convective line into the two distinct systems, Ken and Lola.

After forming, Ken and Lola began to move in similar recurvature tracks. Ken tracked northward into the Sea of Japan reaching a maximum intensity of 60 kn. Lola intensified into a typhoon and eventually transitioned into an extratropical system over the cooler waters east of Japan.

TYPHOON MAC

Typhoon Mac developed from a weak surface circulation northeast of Yap during September. This circulation tracked westward, reaching tropical-storm intensity by the 16th. Mac followed the climatological intensification rate for tropical cyclones approaching the Philippines and reached typhoon intensity prior to making landfall. Frictional effects caused the storm to weaken as it tracked across southern Luzon towards the South China Sea. The unexpected development of tropical storm Nancy east of Hai-nan Island influenced Mac's track in the South China Sea.

Real-time forecasts do not always reflect the actual intensity of a tropical cyclone. Rapid intensification or weakening, peripheral data unavailable due to geographical restrictions, and tight maximum wind bands, which are not initially detected, all reduce the accuracy of intensity estimates provided in tropical-cyclone warnings. These discrepancies often are not recognized until postanalysis, as in the case of typhoon Mac.

Reanalysis of aircraft reconnaissance data for September 16 to 18 shows that most probably Mac reached typhoon intensity by 1800 on the 16th. Aircraft reconnaissance at 0503 on the 16th reported 68 kn at 1,500 ft and 60 kn at the surface. Reconnaissance data at 0810 on the 17th confirmed typhoon intensity by locating 80- to 90-kn surface winds in a 10-mi-wide band tucked under a strong eastern feederband. Mac made landfall prior to the next scheduled aircraft fix with geographical constraints severely reducing peripheral data collection.

Although real-time data were available which indicated Mac had possibly reached typhoon intensity, the isolated reports of strong winds were dismissed as gusts associated with lower velocity sustained winds. Reanalysis of the period between 1800 on the 15th and 0000 on the 18th shows that Mac reached typhoon intensity before weakening from frictional effects over Catanduanes Island on September 18.

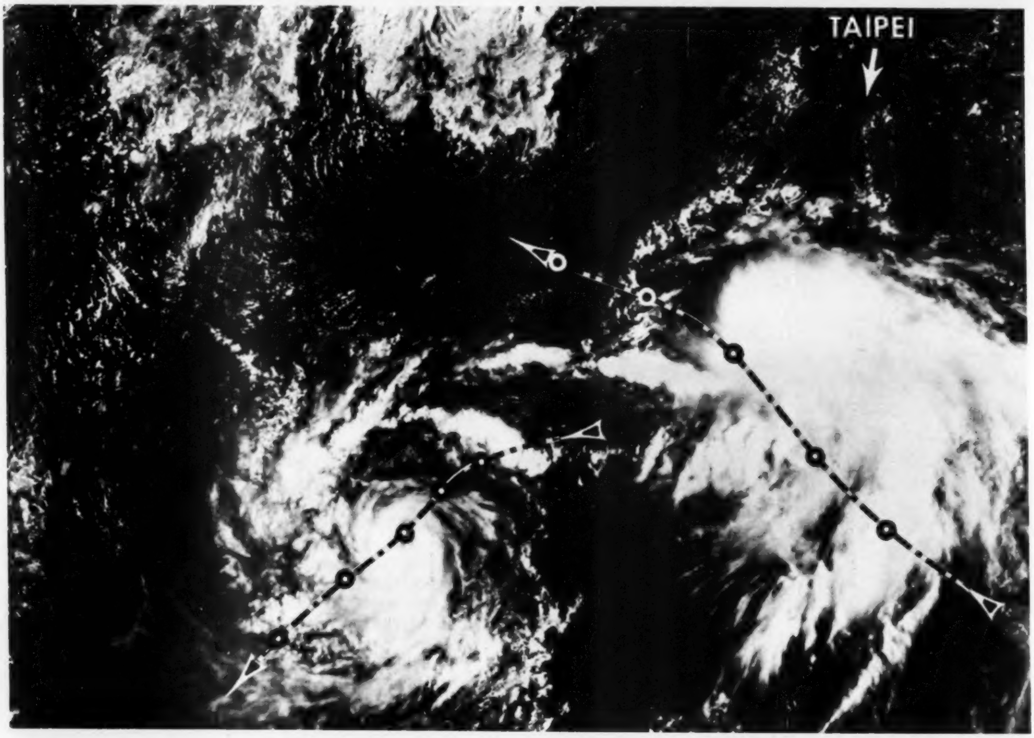


Figure 36.--Typhoon Mac and tropical storm Nancy undergoing Fujiwhara interaction over the South China Sea, at 0302, on September 22, 1979. The 48 hr tracks before and after picture time are superimposed. Dots bracket 24 hr intervals. (DMSP imagery)

The unexpected development of a second tropical cyclone in the South China Sea produced a series of track and intensity modifications in typhoon Mac. On exiting the Philippines, Mac was originally forecast to track west-northwestward into the South China Sea, but instead he began a Fujiwhara interaction (fig. 36) with the rapidly developing tropical storm Nancy located near Hai-nan Island. Mac tracked toward the north-northwest, skirting Cubi Point Naval Air Station in the Philippines on his new track toward Hong Kong. Strong anticyclonic outflow from Nancy sheared Mac's convection towards the southwest with aircraft reconnaissance reporting an exposed low-level circulation of 30- to 35-kn intensity on the 20th.

Weak steering currents allowed Nancy to take a cyclonic track across southern Hai-nan Island before heading southwestward into Vietnam. Nancy's southwestward track forced Mac farther north. Mac eventually passed just south of Hong Kong. Ironically, Nancy's development, which caused Mac to track towards Hong Kong, also helped to spare Hong Kong from potential typhoon-force winds. Nancy's upper level outflow, which dominated the South China Sea from September 19 to 23, produced strong vertical shear over Mac and slowed his rate of intensification. Typhoon Mac reached only minimal tropical-storm intensity prior to landfall west of Hong Kong.

A preliminary report from the Royal Oservatory, Hong Kong on Mac and Nancy can be found in the January 1980 issue.

TYPHOON OWEN

Typhoon Owen developed from a disturbance which tracked south of Guam on September 20. Two days later, satellite imagery showed that the system was organizing at the same time that aircraft reconnaissance data indicated a definite surface circulation with a 1000-mb central pressure.

The system moved on a generally westward track until the 23d, at which time it unexpectedly turned sharply to the north. Postanalysis revealed a possible reason for this movement. An upper level trough was evident on the 200-mb analysis just west of the cyclone. Southerly winds of 50 kn were observed on the eastern periphery of the trough. Considerable vertical shear existed in the layer from 500 mb to 200 mb. It appeared that the steering and depth of this upper level trough rather than the 500-mb steering was the dominant feature in Owen's movement. Under its influence, Owen tracked generally northward throughout his lifetime, although undergoing major changes in speed. He slowed to a barely perceptible 1-kn movement just northeast of Okinawa (at the latitude of the subtropical ridge axis) and then dramatically accelerated to 24 kn 36 hr later under vertically consistent westerly steering. At this time, Owen made landfall near Osaka, Japan, and began weakening in intensity while still accelerating to 47 kn. Eventually, he transitioned into an extratropical system but not before reaching a maximum intensity of 110 kn (fig. 37) on the 26th.

TYPHOON SARAH

Typhoon Sarah was spawned in the monsoonal trough during late September. During the last few days of the month, the circulation meandered slowly toward Luzon under the influence of the southwest monsoon, then looped over Luzon during the first 3 days of October as a midtropospheric short-wave trough moved eastward north of Luzon. Once the short-wave trough had moved east of the circulation, the northeasterly flow intensified and became more of an influence as the circulation finished its loop and began a south-southwestward track.

Figure 37.--Typhoon Owen at maximum intensity of 110 kn, at 0145, on September 26, 1979. (DMSP imagery)

Sarah intensified to typhoon strength while tracking southward, which is quite unusual for a tropical cyclone. Several aircraft reconnaissance flights reported that Sarah had attained typhoon strength, even though her cloud structure was not well organized.

During the first several days of October, when Sarah was slowly developing to typhoon strength and moving south, Palawan Island and the central Philippines were battered by high winds and rain. These areas were inundated by flooding and landslides, which caused massive crop damage and death. Many villages were cut off from any source of food, fresh water, and other necessities for survival. Four deaths were attributed to Sarah. On the 8th, Sarah finally began to track westward, and the weather cleared over Palawan Island and the central Philippines. Aircraft reconnaissance early on the 9th reported that Sarah's structure had become better organized. Previous reports had shown that Sarah was not vertically alined, but on the 9th the midlevel center had become vertically alined with the surface center, upper level outflow improved, and Sarah's intensity increased to 110 kn. In contrast to her unusual origin, Sarah had become a most impressive storm.

Sarah reached peak intensity early on the 10th, then

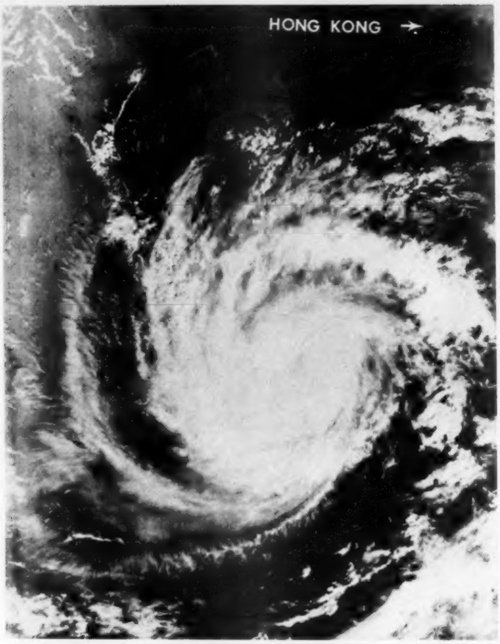


Figure 38.--Sarah with 60 kn intensity one day prior to landfall over Vietnam, at 0136, on October 13, 1979. (DMSP imagery)

began to weaken slowly as she tracked west-northwestward (fig. 38). She continued on a west-northwestward track until dissipation over Vietnam on the 17th. After 20 days, she dissipated within 300 mi of her origin as a monsoon depression on October 28.

SUPERTYPHOON TIP

Supertyphoon Tip was the most significant typhoon of the 1979 season and possibly the most significant tropical cyclone this century. Forty aircraft reconnaissance missions were flown on Tip, which produced 60 fixes, and thus made it one of the most closely watched cyclones in recent memory. Aircraft and synoptic data showed that Tip achieved the lowest sea-level pressure ever observed in a tropical cyclone (870 mb) and also had the largest circulation pattern on record (nearly 1,200 mi in diameter).

Satellite and synoptic data during the early part of October revealed an active monsoon trough that extended from the Marshall Islands through the Caroline Islands to Luzon. Three distinct circulations developed in this trough: one near Manila, which would become typhoon Sarah; another southwest of Guam, which would become tropical storm Roger; and the last between Truk and Ponape, which was destined to become supertyphoon Tip.

The surface analysis for 0000 on the 3d showed the three circulations in the monsoon trough with strong cross-equatorial flow, most of which was feeding into tropical storm Roger. This situation was enhanced by an extratropical trough north of Roger over southern Japan. The split in the surface flow pattern near Guam tended to keep Tip from developing rapidly while southeast of Guam. The satellite signature of the tropical disturbance near Truk continued to show improvement despite an initially unfavorable upper air pattern. At 0900 on the 4th reconnaissance aircraft found a closed surface circulation about 120 mi southeast of Truk with a mean sea-level pressure of 1003.9 mb and a maximum observed surface wind of 25 kn.

On the 5th reconnaissance aircraft fixed the disturbance about 100 mi southeast of the previous position. Although the surface pressure had not dropped significantly, the observed surface winds had increased, and as a result the tropical depression was upgraded to tropical storm Tip at 0000 on the 6th.

Tip moved erratically until the 8th. He first executed a cyclonic loop southeast of Truk, then accelerated to the northwest, only to stall and meander to a position south of Truk. It was difficult to keep track of the surface position during this period. The best track is based almost entirely on aircraft surface positions, because the satellite fixes were based on upper level outflow centers, and even the 700-mb center, as observed by aircraft reconnaissance, was considerably displaced from the surface center. Changes in the surface wind direction reported by Truk assisted JTWC in monitoring tropical storm Tip during this period of erratic behavior.

On the 8th the expected northwesterly movement began. Roger was far to the north becoming extratropical, and the southerly winds that had been flowing north began to veer toward Tip. The upper air outflow channel improved. The 0208 aircraft fix confirmed that Tip was heading toward Guam at approximately 13 kn. The minimum sea-level pressure had dropped to 995 mb, and the surface winds were 40 kn.

Tip continued to intensify and accelerate toward Guam. Six hours before expected landfall, however, reconnaissance aircraft and radar positions from Andersen Air Force Base showed that he had turned westward. Tip actually passed south of Guam, reaching the closest point of approach about 25 mi south of southern end of the island at 1015 on the 9th. Maximum winds of 48 kn with gusts to 64 kn were recorded at the Naval Oceanography Command Center on Nimitz Hill. Andersen Air Force Base recorded a total of 9.1 in of rain.

Shortly after passing Guam, Tip reached typhoon strength and continued on a basic west-northwestward track. The analyses over the next few days showed that typhoon Tip was moving into an area of strong upper level divergence which covered most of the western Pacific. Rapid intensification was forecast, but it was much more rapid than expected as the pressure between the 9th and 11th dropped 98 mb to 898 mb. Tip reached supertyphoon strength at that time with maximum winds of 130 kn reported by aircraft reconnaissance. The circulation pattern associated with typhoon Tip had increased to a diameter of 1,200 mi, which exceeds the previous record of 720 mi set by typhoon Marge in August 1951.

Supertyphoon Tip intensified still further, and at 0353 on the 12th a reconnaissance aircraft recorded the lowest sea-level pressure ever observed in a tropical cyclone: 870 mb. This was 6 mb lower than the previous record set by supertyphoon June in No-

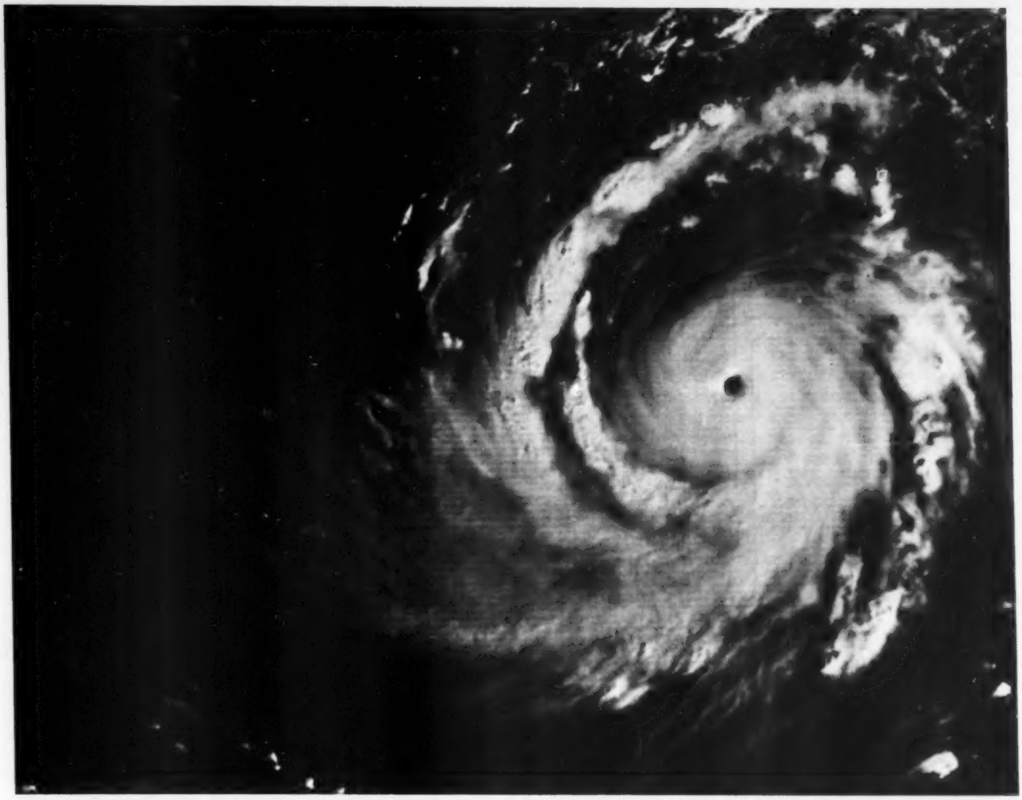


Figure 39. --Supertyphoon Tip shortly before the record MSLP of 870 mb was observed by reconnaissance aircraft, at 0012, on October 12, 1979. (DMSP imagery)

vember 1975. The 700-mb height was 1,944 m, and the 700-mb temperature within the eye was an exceptionally high 30°C (fig. 39). The Aerial Reconnaissance Weather Officer (ARWO) reported that an unusual feature was the spiral striations on the wall cloud. It looked like a double helix spiraling from the base of the wall cloud to the top, making about two revolutions in climbing. Tip maintained supertyphoon strength for the next 54 hr while moving northwestward at 3 to 7 kn. An estimated maximum wind of 165 kn was reached at 0600 on the 12th.

From the 13th to the 17th, the radius of surface and gradient-level 30-kn or greater winds extended over 600 mi from Tip's center. The radius of over 50-kn winds was over 150 mi (fig. 40). Aircraft reconnaissance data likewise showed that 700-mb winds of 105 kn existed more than 120 mi from Tip's center during this period (fig. 41).

After the 17th Tip began to weaken as the large circulation pattern began to shrink and turned northward. By the 18th Tip was accelerating to the northeast. During recurvature, Tip passed within 35 mi of Kadena Air Base on Okinawa, which reported maximum sustained winds of 38 kn with gusts to 61 kn.

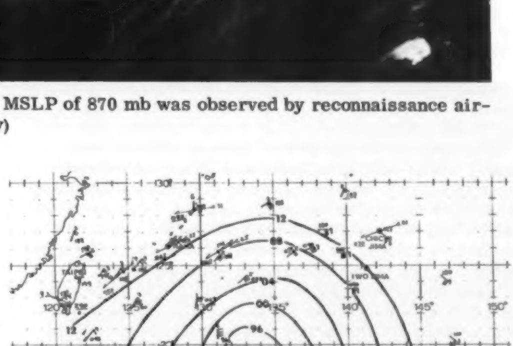


Figure 40. --The 0000 October 14, 1979 surface pressure analysis in the vicinity of supertyphoon Tip.

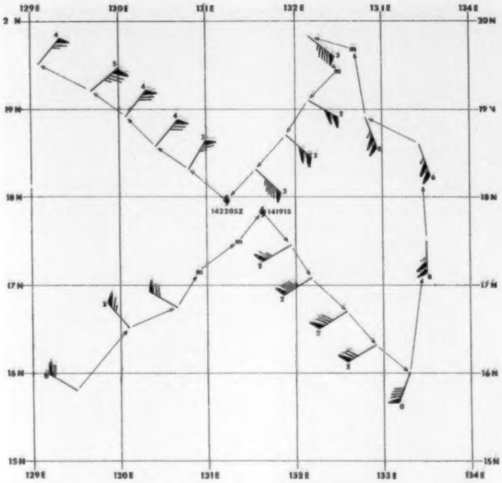


Figure 41.--Plot of aircraft reconnaissance data from supertyphoon Tip on October 14, 1979. Tip's positions were fixed at 1915 and 2205. Windbarbs are the measured 700 mb winds. The tens digit of the wind direction is also plotted with the wind barbs. An "m" indicates no 700 mb wind data available.

Early on the 19th Tip made landfall on the Japanese island of Honshu, about 60 mi south of Osaka, with maximum winds of 70 kn. Synoptic and radar data from stations on the island showed that Tip had a speed over 45 kn as he passed to the north of Tokyo and eastward into the Pacific Ocean. Tip became extratropical over Honshu.

The extratropical low-pressure center maintained winds of storm force (48 kn) until the 21st, when it moved to a position east of Kamchatka and finally began to fill rapidly.

The majority of the severe damage occurred in Japan, where the agricultural and fishing industries sustained losses into the millions of dollars. Flooding from Tip's rains also breached a fuel retaining wall at Camp Fuji, west-northwest of Yokosuka. The fuel caught fire causing 68 casualties, including 11 deaths, among the U.S. Marines stationed there.

Considering the size and strength of supertyphoon Tip, the western Pacific fared well. Luckily, maximum intensity was reached while the system was still far from any inhabited areas, but the potential for mass destruction was always there. From a strictly meteorological standpoint, Tip was also a thing of great beauty. Another ARWO stated upon returning from a mission that the second penetration was beyond description. This is unquestionably the most awe-inspiring storm I have ever observed....The moon had risen sufficiently to shine into the eye through an 8-mi clear area at the top of the eyewall. To say it was spectacular is totally inadequate...'awesome' is a little closer.

SUPERTYPHOON VERA

Vera, the fourth and final supertyphoon of the season, originated in an active near-equatorial trough which extended through the Caroline and Marshall Islands. Vera was first analyzed as a weak surface circulation 100 mi southeast of Ponape on October 27.

Synoptic data on the 30th indicated that low-level inflow was now concentrated into the developing cyclone. The convective activity increased rapidly on the 31st. On November 1 aircraft reconnaissance found an ill-defined circulation center with a central pressure of 1004 mb. On November 2 rapid intensification occurred, and Vera was upgraded to a tropical storm. She reached typhoon strength by the 3d, while 190 mi south-southeast of Yap.

From the first warning until her approach to the Philippines northeast of Samar, Vera moved on a virtually straight west-northwest track. She continued to intensify during her west-northwestward acceleration and reached supertyphoon intensity only 18 hr after being upgraded to a typhoon. Reconnaissance aircraft reports indicated Vera maintained supertyphoon intensity for over 24 hr before weakening as she approached Catanduanes Island. The peak wind reported on Catanduanes Island was 50 kn at 1200 on the 5th as Vera passed just off the coast. Vera made landfall north of Tarigtig Point packing winds of 90 kn.

After landfall, the onset of enhanced low-level northeasterly flow over the Taiwan Straits coupled with strong upper-level southwesterlies over the Philippines resulted in vertical disorganization and rapid weakening of Vera. Radar and aircraft reports indicated the low-level circulation continued to track to the northwest over the Cagayan River Valley and exited into the South China Sea near Culili Point south of Laoag. The upper level circulation sheared off near Tuguegarao and was tracked using satellite imagery northward over Aparri then east-northeastward into

Figure 42.--Tracks of low-level and upper level centers after the upper level sheared off over northern Luzon. Synoptic and ship reports at 0000, on November 7, indicate secondary low-level center near Baguio (indicated by a star). The 0000 center positions are indicated by solid dots. Windspeeds are in knots.

the Philippine Sea. Surface synoptic and ship reports at 0000 on the 7th showed a secondary surface center near Baguio. At the same time, the primary center was crossing the Cordillera central mountain range 95 mi to the north (fig. 42).

After exiting into the South China Sea, the strong northeast monsoon flow accelerated Vera southwestward, and on the 7th she was downgraded to a tropical depression.

TYPHOON ABBY

Abby, the last typhoon of the season, developed over the Marshall Islands during early December. Abby proved to be an unusual cyclone in several ways. Throughout much of her existence, she was not vertically alined. Aircraft reconnaissance located the midlevel circulation center displaced as much as 55 mi from the surface center. At one point, two centers were identified. In addition, Abby fluctuated between tropical-depression and tropical-storm strength several times before reaching typhoon strength 10 days after formation.

On the 2d aircraft reconnaissance observed surface winds of 45 kn and a sea-level pressure of 996 mb. The surface and 700-mb centers were displaced by 12 mi, but Abby continued to intensify to 60 kn on the 4th, while increasing the displacement between the surface and 700-mb centers.

All available information indicated continued intensification as Abby tracked towards Guam. However, the opposite occurred. As Abby moved west of Truk, she weakened to less than tropical-storm strength. By the 7th Abby reintensified to minimum tropical-storm strength as she moved westward. During the 8th Abby once again weakened to less than tropical-storm strength and increased her forward speed of movement.

Abby was not vertically alined from the 1st through the 9th. On the 9th aircraft reconnaissance observed that Abby possessed multiple 700-mb centers, but a few hours later only one well-organized, intensifying center was found. The following is a storm mission summary by the ARWO, who made the double penetration into Abby: "This mission started out as a normal fix but ended up being unusual. On our way inbound for the supplemental fix, there was no problem reading winds at flight level or on the surface. Winds were 20 to 25 kn the entire way. An area of thunderstorm activity became visible ahead of us. As we neared it, the doppler indicated that the 700-mb center was in the middle of the thunderstorm. Not eager to go find this out, we went back to find the surface center. Enroute, we saw surface winds in excess of 35 kn which led us to a fairly disorganized surface center just east of the main thunderstorm. Over it was a fairly small light and variable wind center. Radar showed little curvature in the shower pattern, but the surface winds did indicate a weak circulation existed at this first position. No weather existed to the east of our first fix, and this position was right on the JTWC forecast track. On the second fix, things had changed. As we came in the second time, we encountered considerable precipitation. Doppler and search radar indicated a center with a possible wall cloud forming considerably west of our first fix. Winds were stronger at flight level and we penetrated a wall cloud of about 80-percent coverage. When we broke through, we encountered our strongest winds at flight level. The surface center was under the eastern wall cloud with a small light and variable wind center at 700 mb centered in the eye. Lightning started in the eastern wall cloud and spread around the eye. Our drop was made as close to the surface center as was possible and indicated a good 988-mb sea-level pressure. The 700-mb height was down 72 m from the first fix. The positions were 85 mi apart causing me to believe that two centers existed for a short time with the latter becoming the predominant one. The pressure profile seems to indicate this theory...."

Satellite imagery at 0144 on the 9th also indicated the possible existence of multiple outflow centers (fig. 43). While Abby was reorganizing into a single center, she began to reintensify to tropical-storm intensity, which made her the last typhoon of the decade.

Typically, recurving typhoons have their maximum intensities either before or less than 12 hr after recurvature. Abby, however, did not reach maximum intensity until 36 hr after recurvature. By the 13th Abby reached maximum intensity of 110 kn with a minimum sea-level pressure of 951 mb (fig. 44). As she continued toward the east-northeast, Abby approached a regime of very strong westerlies in the middle and upper troposphere. The strong westerlies induced Abby's acceleration and rapid weakening. Abby dissipated on the 14th due to strong vertical shear between the surface and middle levels.

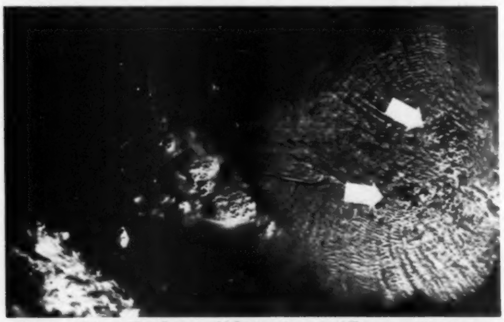


Figure 43.--Typhoon Abby's two outflow centers are indicated by arrows, at 0144, on December 9, 1979. (DMSP imagery)

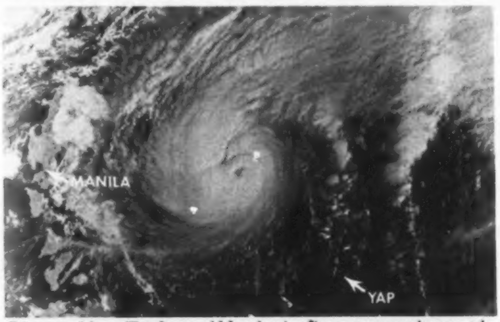


Figure 44.--Typhoon Abby just after recurvature, at 0021, on December 12, 1979. (DMSP imagery)

Hints to the Observer

DIURNAL PRESSURE VARIATION AND TROPICAL CYCLONE DEVELOPMENT

Similar to ocean tides, atmospheric pressure rises and falls twice a day. This pressure "tide" is called diurnal pressure variation. During each 24-hr period two highs occur, one at approximately 1000 and the other at 2200, local time. The two lows occur at approximately 0400 and 1600, local time. The range of the diurnal pressure change is greatest in tropical areas and becomes smaller toward the middle and higher latitudes. In the middle and higher latitudes, the movement of storm centers during much of the year causes such large changes in pressure that the normal diurnal variation is masked. In tropical waters, however, the barograph trace will usually show the familiar sine curve, with two crests and two troughs during a 24-hr period, as illustrated in the barogram (fig. 45).

In the Tropics, changes from the normal diurnal pressure pattern may indicate formation of a tropical cyclone. The usual signs are that the minimum trough of the barograph trace or other pressure record is much deeper, or that the maximum fails to develop. By use of the barograph and reference to one of the marine atlases it is possible to tell whether or not the change from the normal diurnal value is significant. Under normal conditions the diurnal variation should oscillate about the mean pressure value. Whenever the diurnal value drops 3 to 5 mb below the mean pressure during the hurricane season, a tropical cyclone is probably developing in the area. Figure 45 shows a normal range of diurnal pressure variation for tropical latitudes. Note the drop in pressure prior to the normal crest of the diurnal high and the sharper than normal drop in pressure as the PRESIDENT MADISON approached tropical storm Agatha. Other significant weather parameters should be observed, depending on the location of the ship, such as a change in the wind direction to a westerly component or higher than the normal windspeeds; an increase in shower activity which tends to persist; and an increased swell pattern or a swell pattern moving from an unusual direction for the particular waters.

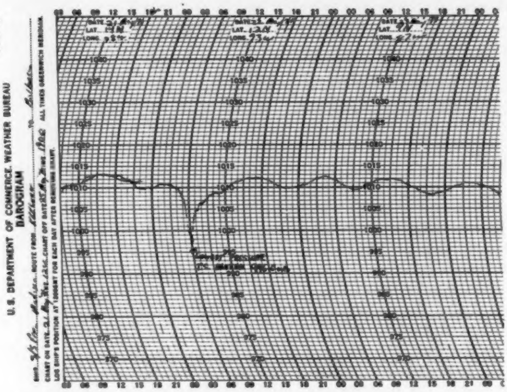


Figure 45. --Barogram of the PRESIDENT MADISON showing normal diurnal pressure variations and pressure drop when Agatha was encountered.

Tips to the Radio Officer

Thomas H. Reppert
National Weather Service, NOAA
Silver Spring, Md.

ALASKA WEATHER DISSEMINATION

Effective June 15, 1980, the National Weather Service re-established HF radio service at station KC194, Nome. Weather forecasts and warnings are broadcast at 0630 and 2030 GMT on a frequency of 4125 kHz (upper sideband). This frequency will be guarded 24 hr a day for receipt of weather and ice observations as well as special requests for weather information.

NOAA Weather Radio station WXJ69, Yakutat, returned to full operation on May 21. The station transmits marine and public weather forecasts and warnings continuously on 162.55 MHz.

The Coast Guard in Alaska has discontinued all regularly scheduled marine information broadcasts on 2670 kHz (Mariners Weather Log, March 1980). Scheduled weather broadcasts will continue on VHF channel 22 from Coast Guard radio stations NMJ2, Ketchikan; NOJ, Kodiak; NMJ1, Juneau (also remoted to Yakutat); NMJ3, Valdez; and on 6507.8 kHz from NOJ, Kodiak.

RECENT ACTIONS BY FEDERAL COMMUNICATIONS COMMISSION

The FCC has granted approval for the use of channel 17 by public coast stations on the Great Lakes to

transmit weather broadcasts utilizing both F3 and F4 (voice and facsimile) emissions. Radio station WMI, Lorain, Ohio, is seeking license modification so that they may begin using channel 17 for weather broadcasts in spring 1981. WMI currently makes voice and facsimile broadcasts on public correspondence channels 26, 84, 85, and 87.

In another action, the FCC is considering an application from AT&T to discontinue weather broadcasts from their Public Class II-B affiliated stations. The stations involved are WOU, Boston; WOX, New York; WAQ, Toms River, N.J.; WGB, Norfolk; WAE, Point Harbor, N.C.; WJO, Charleston, S.C.; WNJ, Jacksonville, Fla.; WDR, Miami; WAK, New Orleans; KCC, Corpus Christi; KQP, Galveston; KFX, Astoria, Oreg.; KTJ, Coos Bay, Oreg.; KOW, Seattle; KLH, San Francisco; KOU, San Pedro; WFA/KUZ 385, Tampa, Fla.

CORRECTIONS TO WORLDWIDE MARINE WEATHER BROADCASTS (JANUARY 1979 EDITION)

Page 8
1-0040 Resolution Island, NT, Canada VAW
Delete station.

Page 9
1-0090 Fox River, PQ, Canada VCG
Change name to Riviere au Renard.

Page 20
1-0870 Vancouver, BC, Canada CKN
Delete frequencies; insert 124, 4497.5, 6946, 12125, 15982.

1-0900 Bull Harbor, BC, Canada VAG
Delete times; insert 0450, 1650, 2050.

1-0910 Tofino, BC, Canada VAE
Delete times; insert 0420, 1620, 2020.

Page 39
2-0050 Resolution Island, NT, Canada VAW
Delete station.

2-0070 Cartwright, LB, Canada VOK
Delete time 0050; insert 0120.

2-0120 Sydney, NS, Canada VCO
Delete times; insert 0040, 0310, 0835, 1650, 2050.

2-0150 Charlottetown, PE, Canada VCA
Delete times; insert 0235, 0840, 1605, 2005.

Page 40
2-0170 Fox River, PQ, Canada VCG
Change name to Riviere au Renard.
Delete times; insert 0035, 1235, 1735.

2-0180 Mont Joli, PQ, Canada VCF
Delete times; insert Continuous.

2-0190 Quebec, PQ, Canada VCC
Delete times and frequencies; insert Continuous 161.65 MHz (F3).

2-0200 Montreal, PQ, Canada VFN
Delete times and frequencies; insert Continuous 161.65 MHz (F3).

2-0220 Yarmouth, NS, Canada VAU
Add: Continuous 161.65 MHz (F3).

Page 54
2-1300 Prince Rupert, BC, Canada VAJ
Delete times and frequencies; insert:

0340, 0845, 1305	1630 (A3H)
1550, 1840, 2150	2054 (A3H)
	161.65 MHz (F3).

2-1310 Sandspit, BC, Canada VAH
Delete frequency 2054 (A3H).

2-1320 Bull Harbor, BC, Canada VAG
Delete times and frequencies; insert:

0445, 1345,	1630 (A3H)
1940, 1540	2054 (A3H).

2-1330 Alert Bay, BC, Canada VAF
Add frequency 2054 (A3H).

2-1340 Spring Island, BC, Canada VAE2
Delete station.

Page 55
2-1350 Tofino, BC, Canada VAE
Add frequency 2054 (A3H).

2-1360 Conox, BC, Canada VAC
Add time and frequency: 2335 2054 (A3H).

2-1370 Vancouver, BC, Canada VAI
Delete times and frequencies; insert:

0410, 1315, 1610	1630 (A3H)
1910, 2310	161.65 MHz (F3)
	2054 (A3H).

ACKNOWLEDGMENTS

Thanks to Radio Officers Robert C. Falardeau, Harry W. O'Brien, Eugene L. Sylvia, Jr., M. L. Ballou, and James DiFalco, NWS, for recent information relative to the marine weather program.

THE MARINERS WEATHER LOG WELCOMES ARTICLES AND LETTERS FROM MARINERS RELATING TO METEOROLOGY AND OCEANOGRAPHY, INCLUDING THEIR EFFECTS ON SHIP OPERATIONS.

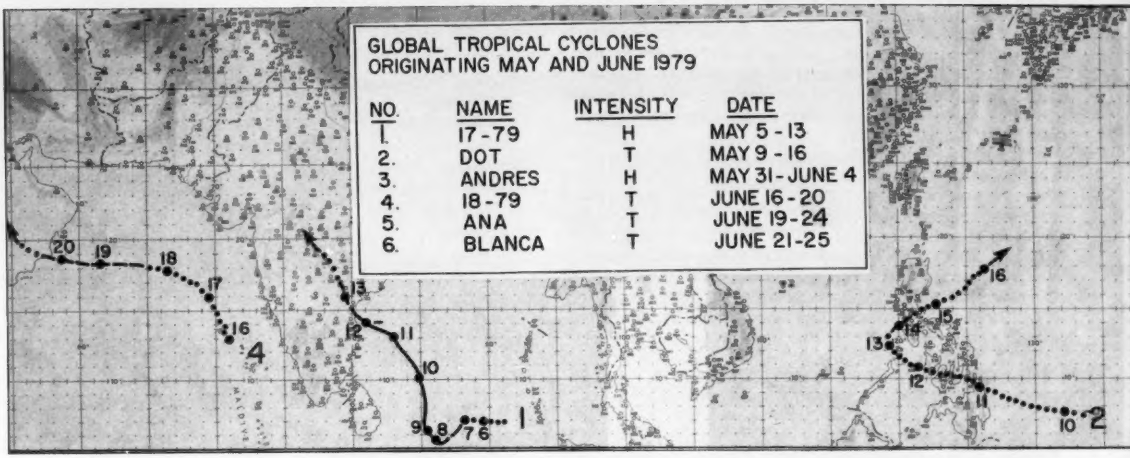


Figure 46.--Global tracks of tropical cyclones originating in May and June 1979.

Hurricane Alley

Dick DeAngelis
Environmental Data and Information Service, NOAA
Washington, D.C.

GLOBAL TROPICAL CYCLONES MAY AND JUNE 1979

Six tropical cyclones roamed the tropical seas (fig. 46) during this 2-mo period in 1979. They were all confined to the Northern Hemisphere. Two reached hurricane strength--storm 17-80 in the Bay of Bengal and Andres in the eastern North Pacific. Three tropical cyclones originated in each month; the hurricanes both formed in May. In an average season about eight tropical cyclones develop, four of which reach hurricane strength, during the 2-mo period.

The final tracks (fig. 46) and statistics (table 4) were kindly provided by the India Meteorological Department, the Joint Typhoon Warning Center, and the Eastern Pacific Hurricane Center.

During the first 10 days of May there was activity in the Bay of Bengal and Philippine Sea. The Indian Ocean storm developed over the southeast Bay on the 5th; the first occasion during the past 100 yr that a May storm has formed at such a low latitude (7°N) in this basin. The storm reached hurricane strength on the 9th. Maximum winds were estimated at about 85 kn and minimum sea-level pressure at 967 mb on the 11th. It crossed the coast near Ongole the following evening. In the Nellore and Prakasam districts strong winds blew all day on the 12th; gusts reached 85 kn. Widespread, heavy rains fell over Andhra Pradesh on the 12th to 14th; 8 to 15 in totals were common. Damage from the winds and rain was extensive; about 700 lives were lost. Storm tides ran 3 to 12 ft near Woolapalam and Padaganjam, about 10 ft near Suryalanka, and 6 to 10 ft from Nizampatnam to Hamsaladivi. Heavy rains and strong winds also affected Madras City and the Chingleput district.

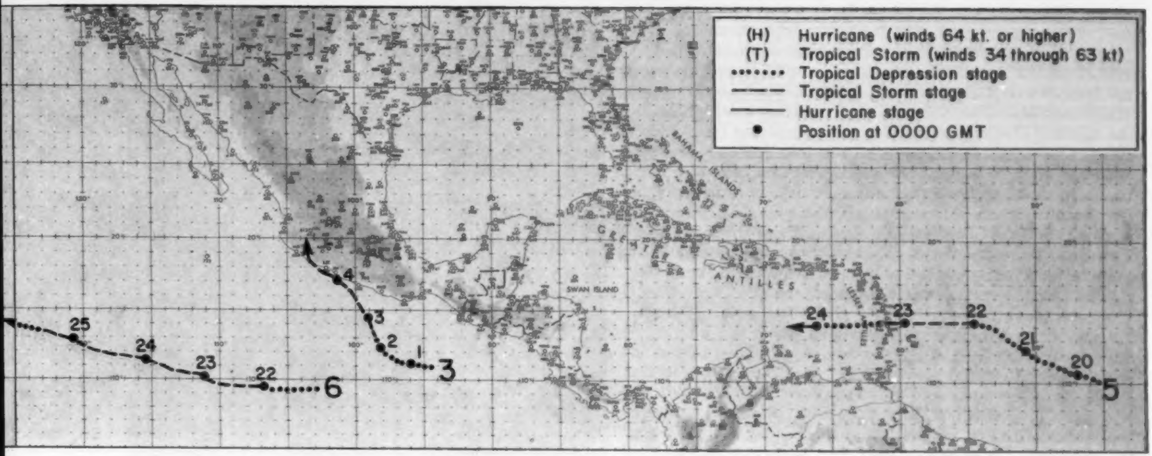
Table 4.--Global tropical cyclone summary, May and June 1979

No.	Name	Peak Intensity	Est. max. wind (kn)	Basin	Dates
1.	17-79	H	85	North Indian	May 5-13
2.	Dot	T	40	W. North Pacific	May 9-16
3.	Andres	H	85	E. North Pacific	May 31-June 4
4.	18-79	T	50	North Indian	June 16-20
5.	Ana	T	50	North Atlantic	June 19-23
6.	Blanca	T	45	E. North Pacific	June 21-25

Tropical storm Dot did not reach tropical-storm strength until after crossing the Philippines, and then only briefly. Her development was cut short by the increasing vertical wind shear aloft and the frictional effects of Luzon.

The Tropics were quiet for 2 weeks when hurricane Andres was spotted in the eastern North Pacific on the last day in May. By June 3 he was a hurricane. The following day maximum winds climbed to 85 kn. This same day (the 4th) Andres began to weaken as he moved ashore about 90 mi southeast of Manzanillo, Mexico.

The three June tropical storms developed between the 16th and 21st. The Arabian Sea system reached a peak of about 50 kn and 985 mb before moving ashore along the Arabian coast. This system was responsible for the advance of the southwest monsoon into most parts of Karnataka, Goa, and south Konkan. The first North Atlantic tropical cyclone, Ana, popped up on the 19th. Ana was the first June storm to form east of the Lesser Antilles since 1933 and only the second during the past 100 yr. Maximum winds climbed to 50 kn, while her minimum pressure never got below 1005 mb. Two days after Ana was detected, Blanca came to life in the eastern North Pacific. Blanca actually began as an At-



lantic tropical disturbance but had crossed the Isthmus of Panama and Costa Rica a few days earlier. This is not an unusual occurrence. It also happens between the western Pacific and North Indian Ocean.

SOUTHERN HEMISPHERE
MARCH AND APRIL 1980

Of the eight tropical cyclones during this period (fig. 47), seven formed during March, three reached hurricane strength, and only two of them roamed the South Indian Ocean region.

The Fiji Islands had a rough time as three tropical cyclones passed through the Islands inside of 2 weeks. While none of the trio were hurricanes, their devastation came from torrential rain-producing floods and slides along with storm tides. Wally was the worst. Over a 3-day period he dumped up to 33 in of rain on the Suva area. Suva is the capital and also the principal port of Viti Levu, largest of the Fiji's 250 islands. Suva is no stranger to torrential downpours. During a 13-hr period back in 1906, some 26.5 in was recorded before the rain gage overflowed.

Wally's torrential rains triggered mudslides and floods, particularly along the southern coast of Viti Levu. Hundreds of homes were swept away or buried in mud. Nausori Airport was under 2 ft of water for several days. Crops and roads were hard hit. There were 16 deaths attributed to the storm.

The area was just recovering from Tia, which had struck less than 2 weeks before. Tia's rains had caused problems on several of the islands. Storm tides as well as floods were responsible for damage on Vanua Levu, second largest island in the Fiji's. In Rukuruka Bay, along the island's northern coast, the tug RIGOROUS and the fully laden barge LAUTOKA were driven aground. The tug was refloated with minor damage, while the barge had to wait for a higher tide. Three people died during the storm. Between Tia and Wally tropical storm Val moved through the islands, but a little to the east of the Suva Group. No damage reports have been received about this storm.

Gloria was the most intense storm of the 2-mo period. As she frolicked in the seas west of Australia, winds near her center were estimated at about 110 kn late on the 25th (fig. 48) and early the next day. She maintained hurricane intensity from the 24th until the 27th. The other two hurricanes, Sina and Laure, developed at the same time, but an ocean apart. Sina meandered through the Coral Sea, while Laure was romping through the Mascarene Islands. Early on the 13th Sina's winds were estimated at about 70 kn. Before the day was out, however, she fell to tropical-

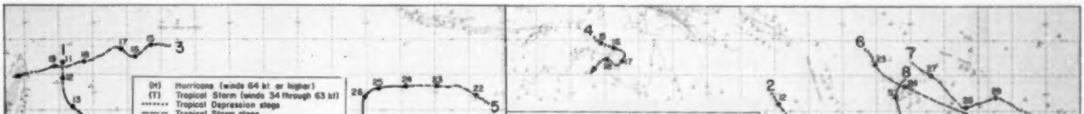


Figure 47.--Southern Hemisphere tropical cyclone tracks, March and April 1980.

storm strength. By the following day she had crossed the 30th parallel and was becoming extratropical. Meanwhile, Laure was churning up the seas around Mauritius and Reunion. Maximum winds were estimated between 80 and 90 kn on the 13th. Port Louis in Mauritius was closed for the day. The previous day the CITY OF LONDON had stopped unloading cargo and left the harbor. However, she ran into Laure's heavy seas and got clobbered. Damage included loss of a lifeboat and flooding, which resulted in damage to electrical equipment. The ship returned to Port Louis for repairs. Laure remained at hurricane strength well into the 15th. Two days later she was a dissipating tropical depression.

Maximum winds in the other two tropical storms during the period were never estimated above 40 kn. They also both formed on the same day--the 14th. Doris briefly roamed the seas off northern Australia before moving into the Gulf of Carpentaria and ashore over Arnhem Land. Tropical storm 15-80 developed south of the Diego Garcia Islands and moved west-southwestward. After winds climbed to 45 kn on the 15th, there was no further intensification. Shortly before moving ashore over the northeast coast of the Malagasy Republic, the system dropped to tropical-depression strength.

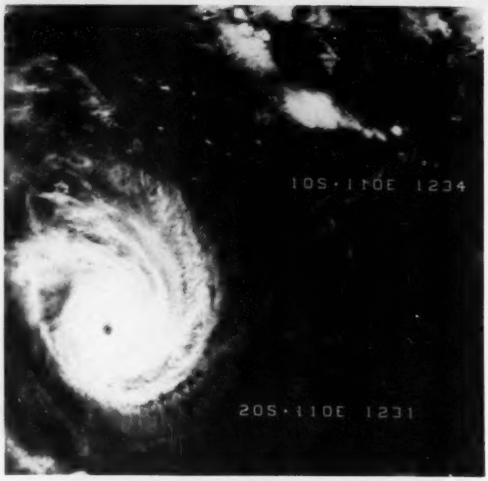


Figure 48. --Gloria in all her glory--a mature beauty on the 25th at 1232.

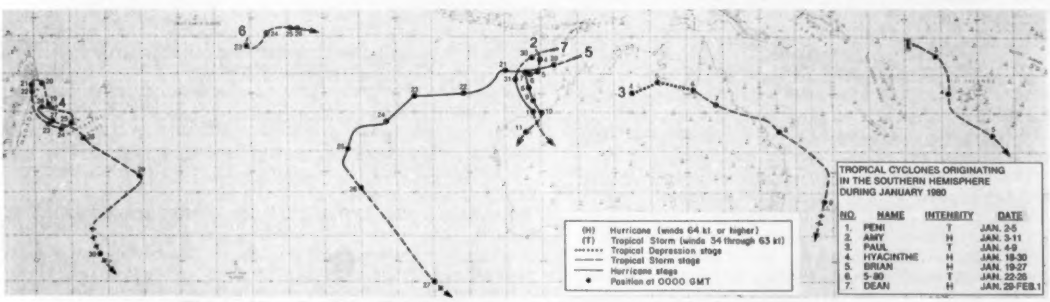


Figure 49. --Southern Hemisphere tropical cyclone tracks, January 1980.

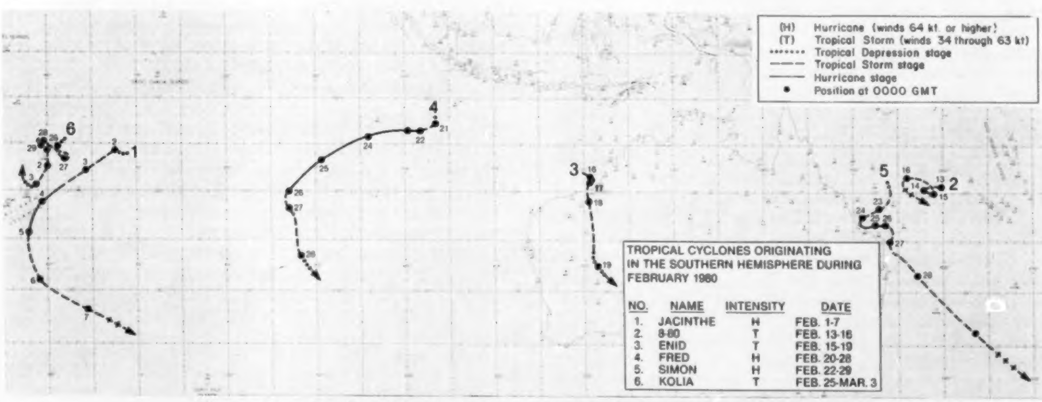


Figure 50. --Southern Hemisphere tropical cyclone tracks, February 1980.

Table 5.--World tropical cyclone watch, 1980

Australia-South Pacific

Peni	TS	Jan.
Amy	H	Jan.
Paul	TS	Jan.
Brian	H	Jan.
Dean	H	Jan.
8-80	TS	Feb.
Enid	H	Feb.
Fred	H	Feb.
Simon	H	Feb.
Sina	H	March
Doris	TS	March
Gloria	H	March
Tia	TS	March
Val	TS	March
Wally	TS	April

South Indian

Hyacinth	H	Jan.
5-80	TS	Jan.
Jacinthe	H	Feb.
Kolia	TS	Feb.
Laure	H	March
15-80	TS	March

Western North Pacific

Carmen	TS	April
Dom	H	May
Ellen	H	May
Forrest	T	May
Georgia	T	May
Herbert	T	June

Eastern North Pacific

Agatha	H	June
Blas	T	June
Celia	H	June

REPRINTING OF JANUARY AND FEBRUARY 1980 CHARTS

The tropical cyclone tracks in the last issue for the Southern Hemisphere January and February 1980 can be seen in figures 49 and 50. The background land masses and the latitude and longitude lines were illegible because of poor-quality printing. Hope these turn out better.

TROPICAL CYCLONE WATCH - 1980

The tropical cyclones that have developed through June of 1980 appear below (table 5). This list must be considered preliminary, since we occasionally miss a storm in the Southern Hemisphere.

On the Editor's Desk

NAVOCEANO SURVEYS GULF FEATURE

The Naval Oceanographic Office (NAVOCEANO) recently noticed an unusual oceanographic feature near the center of the Gulf of Mexico. Scientists from the Fleet Applications Department observed the feature during routine analysis of infrared satellite imagery obtained through the Defense Meteorological Satellite Program. Prompted by this discovery, they boarded a P-3C aircraft from Patrol Squadron 49 out of Jacksonville, Fla., and flew out to locate the anomalous feature. Airborne expendable bathythermographs (AXBTs) were dropped at specific locations in and around the feature. They provided a temperature profile of the water column from the surface to a depth of 304 m (1,000 ft). The feature consisted of a core of abnormally cold water within the northern perimeter of the Loop Current (fig. 51). The Loop Current is part of the usual circulation pattern in the Gulf. It begins in the Yucatan Channel, flows clockwise around the eastern basin of the Gulf, then out through the Florida Straits as the Florida Current, which is a major contributor to the Gulf Stream System.

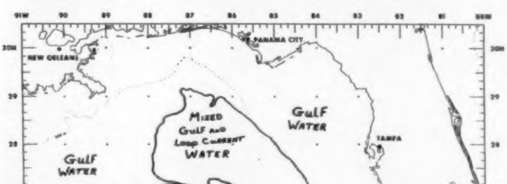


Figure 51.--A map of the Loop Current showing the cold water feature.

NAVOCEANO's quick and comprehensive response to the discovery of this cold water anomaly attracted the attention of several other federal agencies. The National Marine Fisheries Service in Mississippi plans to study the feature's effects on the local fisheries. In some instances an isolated core of water acts like a net surrounding and compacting certain species of fish or shrimp. The National Weather Service, with an office in Slidell, Miss., is watching to see how the feature will affect fog and storm patterns in the near future. It is well known that the heat exchange between water bodies and the atmosphere sets up many meteorological conditions. The Satellite Field Service in Miami, part of the National Environmental Satellite Service, is interested in comparing satellite imagery and AXBT values in hopes of refining the techniques necessary to discover and map similar oceanic features.

MOUNT ST. HELENS

After rumbling for about 2 mo, Mount St. Helens erupted at 8:39 a.m. Pacific Daylight Time (1539Z) on May 18, 1980. Weak earthquakes and minor eruptions had occurred previously. Ash, steam, and sulfur gases had been released. Several new craters had formed, and the north side of the mountain had

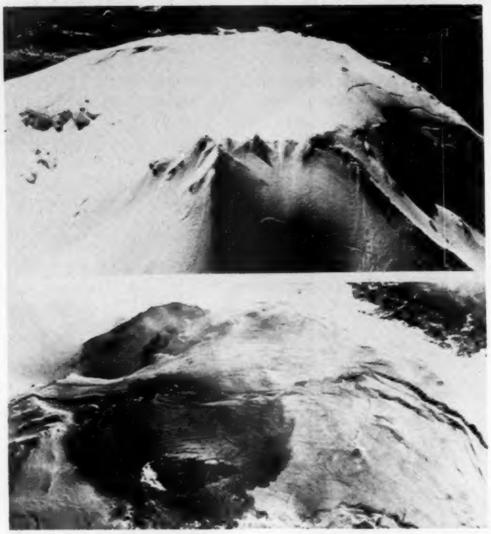


Figure 52.--Two before and after pictures of Mount St. Helens with the same view. The lower photo was taken after the March 27 eruption. Wide World Photo.

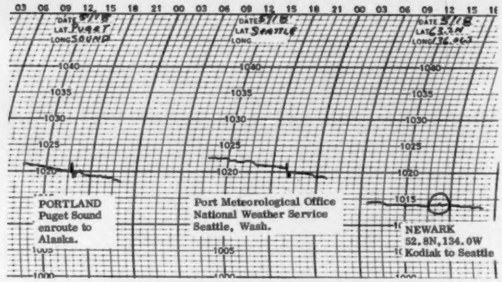


Figure 54.--A composite of the three barograms that sensed the Mount St. Helens explosion. They are from the PORTLAND in Puget Sound, the Seattle Port Meteorological Office, and the NEWARK off Queen Charlotte Island. Thanks to Don Olson, Seattle PMO.

started to bulge (fig. 52).

At 8:39 a.m. and 10:45 a.m. on the morning of May 18, the top literally blew off the mountain (fig. 53). It has been estimated that the explosion was equivalent to a blast of about 10 million tons of TNT. Ash was injected 60,000 ft into the atmosphere. It was so thick that in a few places it seemed like night. It covered everything, choking vehicles and people. Highways and airports were closed. Thousands of acres of trees were knocked down and stripped, and animals within many miles were killed or died.

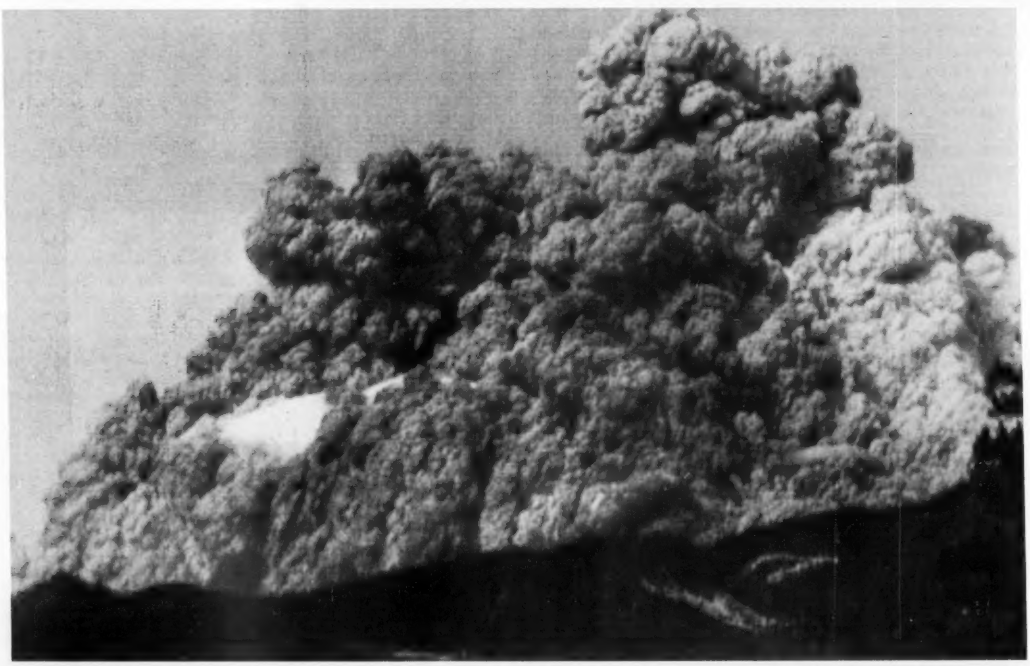


Figure 53.--The last of four dramatic photographs of the Mount St. Helens eruption by Vern Hodgson. The cloud is about 20 mi across and filled with ash, hot rocks, and steam. Copyright 1980 by Vern Hodgson and the Everett, Wash., Herald.

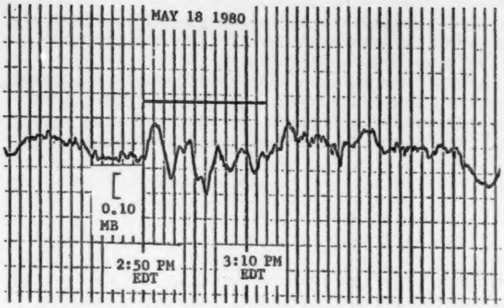


Figure 55.--The trace of a NOAA microbarograph at Washington, D.C. The explosion generated an acoustic gravity wave that was sensed 3,700 km away and 3 hr and 20 min later. The first two waves had periods between 5.5 and 6 min and amplitudes of about 0.21 mb.

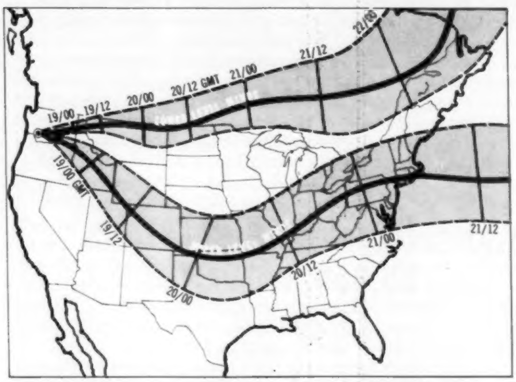


Figure 56.--A map predicting the track of the volcanic plume. The upper level winds represent the 20,000 to 40,000 ft level and the lower level below 10,000 ft.

Mudslides and debris clogged rivers and Spirit Lake. A natural dam of mud and debris built up to 200 ft; it was feared that it would break or collapse. The mud and debris flowed down the Tautle and Cowlitz Rivers to the Columbia River, reducing the normal 40-ft channel to 15 ft. The HOEGH MASCOT and TOKAI MARU were caught in the mud. Up to 50 vessels were immediately affected, about half wanting to go each way on the river. A second large eruption occurred a week later and another on June 12.

The explosion was sensed on barographs thousands of miles away. This included ships at sea (fig. 54) and a microbarograph at Washington, D.C. (fig. 55).

The plume of fine ash was tracked across the United States (fig. 56) by many types of sensors, including satellite. Only the smaller particles remained in the atmosphere longer than a few hours. Some of these fine particles will remain in the stratosphere for months.

By May 27 the Columbia River had been dredged to 21 ft and was open to traffic. A 30 ft deep channel was opened on June 16 for daylight only traffic.

VOLCANIC ASH COULD MASK GLOBAL CARBON DIOXIDE EFFECT

The volcanic ash that Mount St. Helens spewed into the atmosphere could confound efforts to detect climatic effects of human pollution.

The volcanic debris now circling the Earth could block out some sunlight, causing a slight cooling of the Earth's surface that would mask the expected warming effects of increasing carbon dioxide in the atmosphere and delay their detection for more than a decade.

The burning of fossil fuels adds carbon dioxide to the atmosphere. NOAA's Geophysical Monitoring for Climatic Change program maintains observatories at remote locations around the globe to monitor the minor constituents of the air, such as carbon dioxide, that may influence global climate.

Measurements at these stations, some going back to 1958, have shown a 5-percent increase in atmospheric carbon dioxide over the past 2 decades. Furthermore, the annual rate of increase is growing, and scientists predict that within 50 yr the concentration of carbon dioxide in the atmosphere will be double what it was before the Industrial Revolution.

The temperature effect of that doubling would be a net warming near the Earth's surface of about 4° to 5°F (2° to 3°C) averaged over the Northern Hemisphere. In the stratosphere the opposite effect would occur, with a cooling that would be significantly greater in magnitude than the surface warming.

During the next 5 to 10 yr NOAA and other scientists hope to detect, in an "early warning" sense, the carbon dioxide-induced global temperature increase of a few tenths of a degree that might confirm this prediction.

There is strong evidence from earlier large volcanic eruptions that particles and gases from these eruptions entered the stratosphere and, after spreading over much of the Earth, caused slight cooling of the air near the Earth's surface and warming of the stratosphere.

If the St. Helens eruptions injected enough volcanic material high enough in the stratosphere, any temperature changes it causes would mask temperature changes caused by a carbon dioxide increase. This would likely rule out early detection of carbon dioxide-induced temperature changes for perhaps the next 5 to 10 yr and could delay detection until well after 1985. Since any volcano-induced cooling would last less than a decade, it would only temporarily counteract the carbon dioxide warming, which could affect climate for several hundred years.

NOAA SATELLITES TRACK ATLANTIC RACE YACHTS

More than 100 yachts in the Royal Western/Observer Singlehanded Transatlantic Race in June were tracked by satellite during their voyage from Plymouth, England, to Newport, R.I. For the first time in the 20-yr history of the race, organizers of the race and rescue services knew the precise location of each yacht every 6 hr.

Two polar-orbiting satellites operated by NOAA picked up signals from transmitters aboard each boat and sent them to the National Environmental Satellite Service in Suitland, Md.

Atmospheric pressure and temperatures in areas through which the yachts sailed were transmitted. Data of this sort from remote locations are valuable

to weather forecasters and were removed from the data stream by the National Meteorological Center, also in Suitland. The portion of the data used to determine the transmission from the boats was relayed to Toulouse, France, where the French space agency, CNES, operates the Argos data collection system under contract to NOAA.

Computers at Toulouse used the transmissions to determine the exact position of each yacht. This information not only let the world know who was leading the race, but also--if a transmitter on any yacht stopped sending a signal--indicated to rescuers the last known position of a craft that was sunk or abandoned.

During past races, the competitors have rarely been seen at sea, and their positions were known only sporadically. Often, no one knew the leaders in the race until their craft approached Newport.

The Argos data collection system is a major feature of NOAA's TIROS-N series satellites which view the Earth's surface with visual and infrared sensors. Each of the two spacecraft sees every spot on Earth twice in a 24-hr period as they orbit from pole to pole with the Earth turning beneath them.

The Argos electronics package aboard each satellite collects environmental information from remote locations in the oceans, on land, and aloft. Ocean buoys are transmitting sea surface information of value to oceanographers and mariners; land-based platforms in the vastness of the Rocky Mountains and at the headwaters of the Columbia River provide readings of river levels; and transmitters carried aloft in balloons give wind, temperature, and humidity data to weather forecasters.

The system supports the various environmental warning programs operated by the National Weather Service, helping to alert the public against floods, tsunamis, hurricanes, and other hazards. It also provides information to other agencies, among them the Departments of Agriculture and Interior, the Corps of Engineers, and NOAA's National Ocean Survey.

Last year during a French-sponsored yacht race from L'Orient, France, to Bermuda and back, similar transmitters were placed aboard the 30 or so craft competing. Three of the yachts sank, but the NOAA system played a key part in assuring that their crews were rescued.

NEW RECORD SAIL AROUND THE WORLD

British surveyor David Cowper sailed into Plymouth harbor on the morning of April 23, 1980, to complete a 249-day voyage that eclipsed two round-the-world records, including one set in 1967 by the late Sir Francis Chichester.

The voyage took the yachtsman over 30,000 mi. He survived a near-capsizing, negotiated uncharted oil rigs off South America, and endured violent gales and subzero temperatures. He said that there was never a time when he feared he would not make it.

Cowper's actual sailing time was 225 days, breaking Sir Francis' record of 226 days. Cowper also set a record for total sailing time.

A cannon sounded as Cowper entered Plymouth Sound at 9:19, and hundreds of people were on hand at the famous Royal Western Yacht Club to welcome him. Cowper's wife and son came aboard his craft, the 40-ft aluminum-hulled OCEAN BOUND, for an emotional reunion. Cowper said he regarded beating Sir Francis' record as the main achievement. He had mortgaged his house to finance the trip.

Among those hailing his feat was Dame Naomi James, a native of Australia honored by Queen Elizabeth after Dame Naomi's 272-day voyage 2 yr ago. James noted that Cowper's boat was considerably smaller than the others.

SAFETY BOARD RELEASES 1979 STATISTICS

Highway fatalities and transportation-related deaths rose in 1979, but the increases were significantly less than in the previous 2 yr, according to preliminary statistics released by the National Transportation Safety Board.

Both categories increased from 3 to 5 percent in 1977 and 1978. In 1979, highway deaths rose 1.5 percent, and total transportation fatalities were up 1 percent.

On U.S. highways, 51,083 persons were killed last year as compared with 50,331 in 1978, according to preliminary data. All transportation modes registered 55,858 deaths in 1979 and 55,349 in 1978.

The Safety Board Chairman said the Board finds little comfort in these fatality statistics. Transportation accidents are killing more than 55,000 persons each year. More than 50,000 of them still are dying on our highways despite strong evidence that the skyrocketing cost of fuel is reducing the use of those highways. There is one possible trend which is hopeful: Rail-highway grade crossing fatalities last year were

TRANSPORTATION FATALITIES*
55,858 IN 1979

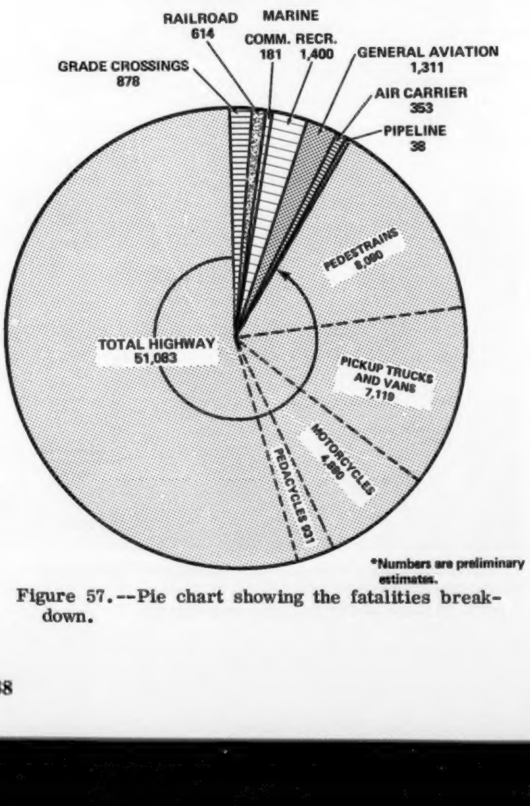


Figure 57.--Pie chart showing the fatalities breakdown.

down by 17.5 percent, and state-by-state totals indicate the primary factor may be the spread and the impact of statewide 'Operation Lifesaver' programs attacking this specific problem area.

In addition to grade crossings, the aviation and railroad modes showed fatality decreases in 1979. Air carrier deaths more than doubled, from 161 to 353, but a reduction from 1,628 to 1,311 in general aviation offset this and produced an overall decrease of 7 percent. Railroad fatalities were down from 632 to 614, or 2.8 percent.

The commercial marine fatalities increased from 179 in 1978 to 181. Total marine fatalities increased from 1,500 to 1,581.

The Safety Board's statistics are further detailed in figure 57.

NORDA DEVELOPS FIRST OPERATIONAL OCEAN FORECAST SYSTEM

The Naval Ocean Research and Development Activity (NORDA) has developed the world's first ocean forecast model designed for operational use. Called the Thermodynamical Ocean Prediction System (TOPS), the numerical model is intended to provide daily 72-hr forecasts of the temperature structure of the upper ocean down to 400 m (1,500 ft) throughout the Northern Hemisphere. The model has been delivered to the Fleet Numerical Oceanography Center (FNOC), Monterey, Calif., in a semioperational mode to undergo formal testing and evaluation. The work was performed by the Laboratory's Numerical Modeling Division.

Temperature fluctuations in the upper ocean occur daily, even hourly, and can critically affect the transmission or reception of acoustic signals by refracting (bending) the paths of sound waves. The Navy's ability to anticipate these changes can substantially improve the performance of sonar systems. In addition, ocean temperature forecasting can have an important impact in the future on weather forecasting, commercial fisheries operations, ocean thermal energy conversion, and pollution control.

TOPS is designed to be coupled with the meteorological forecast system already in operation at FNOC. That model predicts air temperatures, the flow of heat to and from the ocean, rainfall, and the stress of wind velocity on the sea surface. By receiving inputs from that model, TOPS can account for the effects on the upper ocean of solar heating and atmospheric disturbances, including the passage of warm and cold fronts. Such events can greatly modify upper ocean temperatures over vast areas during a period of 72 hr. TOPS for the first time will be able to provide the fleet with real-time predictions of changes in the subsurface environment generated by these atmospheric conditions.

NORDA scientists constructed the computer model by formulating conservation equations for temperature, salinity, and current velocity. The data used by the model include the many ocean temperature measurements made daily throughout the Northern Hemisphere by ships and aircraft dropping expendable bathythermographs plus sea-surface temperature observations by satellites. The data are used by FNOC to make a daily analysis of the ocean thermal structure, which provides the initial temperature field for the TOPS forecaster. The salinity input is obtained from a daily interpolation of FNOC's monthly climatological patterns collected over a period of many years.

Informal and limited test and evaluation studies of the TOPS model have been conducted by NORDA with encouraging results. They will continue to improve and refine the model through forecast verification studies.

LIGHTNING MAPS REVEAL ELECTRICAL MAKEUP OF TORNADO-PRODUCING STORM

The clearest picture yet of the electrical activity evolving from a tornado-producing thunderstorm shows that cloud-to-ground lightning hugs the leading edge of the storm center and becomes active only after the tornado dissipates.

This data was gained from a NOAA study of a major tornado in Lawton, Okla. The storm was 1 of 11 produced when an intense squall line formed in northern Texas and central Oklahoma. The severe storm activity on April 10, 1979, killed 54 persons in Lawton and Wichita Falls and Vernon, Tex.

The connection between lightning and the dynamics of severe storms is poorly understood because of the lack of definitive observations. This is a step toward filling this data gap by producing the first maps of cloud-to-ground lightning for a severe, tornado-producing thunderstorm.

The lightning maps show that during the 60-min electrically active lifetime of the Lawton storm, the flash rate of ground strokes averaged about three per minute. The peak flash rate of over eight per minute occurred 20 min after the tornado left the ground. The

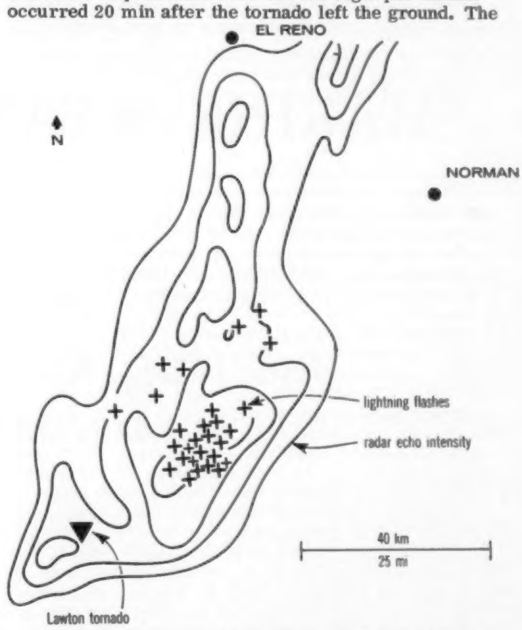


Figure 58.--The first "lightning maps" of a tornado-producing storm show that cloud-to-ground lightning hug the leading edge of the storm center, and became really active only after the tornado died off. This map of April 10, 1979 storm depicts lightning activity for a 5 min period about 25 min after the tornado died out.

lightning was concentrated just outside the storm core; the area of intense precipitation where radar echoes are strongest. This was in the left front quadrant of the northeastward-moving storm.

During the twister's 8-min rampage, it was situated right alongside the lightning and precipitation, all moving along at 20 m/s (45 mi/h). Because of the continued movement of the storm, the surge in lightning activity that occurred about 20 min after the tornado's demise took place roughly 20 km (12 mi) northeast of its surface track.

Only a few other studies of storm flash rate have been made. The cloud-to-ground flash rate of the Lawton storm is about the same as that for typical Florida thunderstorms. Probably, tornado-producing storms have much more cloud-to-cloud lightning.

The Lawton storm's lightning activity was mapped (fig. 58) from two direction-finding sites, one at Norman, Okla., and the other 60 km northwest of Norman near El Reno. At each site a direction-sensitive antenna homed in on the magnetic field radiated by the ground strokes. The location of each flash was determined by the point of crossing of the two bearings.

SATELLITES HIGHLY ACCURATE IN TRACKING HURRICANES

According to a paper by the Satellite Field Services Station, Miami, Fla., in the May issue of Monthly Weather Review, NOAA satellites are locating Atlantic Ocean hurricanes with an average accuracy of about 17 mi and pinpointing their intensity within an average of 10 kn.

Estimates of the locations and maximum sustained windspeeds have been made for all tropical and subtropical hurricanes in the Atlantic, Caribbean, and the Gulf of Mexico since 1971. NOAA's National Hurricane Center "best tracks" data, compiled from satellite reports, reconnaissance aircraft, and other information sources reveal that the average location difference was only about 17 mi, with the average maximum sustained windspeeds about 7 kn. Their ability to estimate accurately the maximum sustained winds is significantly better for storms of at least hurricane intensity (65 kn); that is, for those storms potentially most damaging.

NOAA's National Environmental Satellite Service operates two satellite systems: geostationary spacecraft orbiting 22,300 mi above the Equator and monitoring the U.S. East and West Coasts; and two polar-orbiting spacecraft at altitudes of about 540 mi viewing every spot on Earth four times every 24 hr.

The East Coast geostationary GOES satellite is used by the Miami station to track hurricanes in the Atlantic, Caribbean, and the Gulf. It provides a new picture of the area beneath it every 30 min and, because of its orbit, always has the eastern two-thirds of the United States, all of South America, and most of both the North and South Atlantic Oceans in view. It obtains both visual and infrared imagery, permitting it to see the land and oceans 24 hr a day.

MARINE WEATHER REVIEW

The Smooth Log (complete with cyclone tracks, climatological data from U.S. Ocean Buoys, and gale and wave tables) is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The Rough Log is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both Smooth and Rough Logs, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

Smooth Log, North Atlantic Weather

January and February 1980

SMOOTH LOG, JANUARY 1980--Fewer major cyclone centers than normal traversed the North Atlantic this month. The primary track followed climatology fairly closely from the Gulf Coast and off the Atlantic Seaboard to about latitude 40°N. At that latitude the paths fanned out and spread from due north toward the Labrador Sea to northeastward toward the Norwegian Sea. There was a well-defined track across the Great Lakes, but most storms dissipated before reaching the Labrador Sea in accordance with climatology. An average of one cyclone a week visited the Mediterranean.

The monthly mean sea-level pressure chart showed the 999-mb Icelandic Low shifted southwestward from its normal position to near 57°N, 48°W. There were two major troughs out of the LOW, one paralleling the East Coast and the other southward along longitude 40°W. The Azores High was near normal at 1020 mb (fig. 59).

The primary negative anomaly center was 6 mb between Newfoundland and Kap Farvel. A broad lesser negative area was associated with the two troughs. Of importance to the weather and reflecting the lack of storm centers passing over the Greenland and Norwegian Seas was a large positive anomaly over that area.

The upper-air pattern as reflected by the 700-mb level indicated zonal flow between latitudes 30°N and 50°N. There was an anomalous closed-LOW center over the Labrador coast near Hopedale. The normal ridge over western Europe was accentuated over Iceland.

According to wave climatology there is a large area

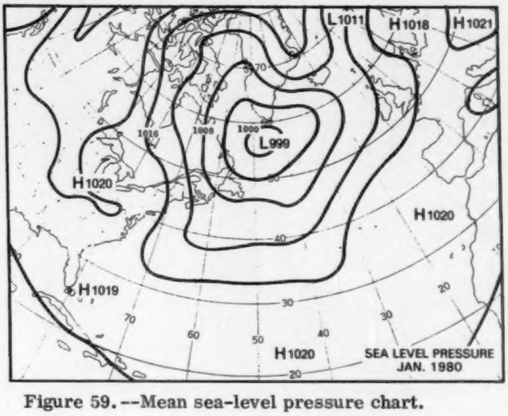


Figure 59.--Mean sea-level pressure chart.

between latitudes 40°N and 60°N where the probability of having waves equal to or greater than 12 ft is 50 percent.

Extratropical Cyclones--The first significant storm of the month began in a shallow LOW off the Carolinas on the 1st. On the 2d the AMERICAN RANGER found 50-kn winds and 20-ft waves near 34°N, 66°W. On the 3d the winds increased to 65 kn and the waves to 23 ft. The storm was growing, and at 1200 it was 976 mb at 39°N, 58°W. Other ships were now being included, and the SEALAND PACER fought 60-kn winds and 33-ft waves near 40°N, 59°W. On the 4th the DART EUROPE (50°N, 43°W) and MARGOT JACOB (42°N, 54°W) both had winds of 60 kn, with the latter contending with 39-ft seas. Many other ships had winds and seas in the 40- to 60-kn and 20- to 30-ft range.

The storm was on a northerly track and on the 5th was between Cape Race and Kap Farvel. Winds over 50 kn continued south of the center, and waves up to 25 ft were found as far south as latitude 37°N. The GEORGE WALTON (43°N, 43°W) battled 47-kn winds and 39-ft waves, while the MARGOT JACOB (42°N, 45°W) encountered 60-kn winds and 33-ft waves.

On the 6th the LOW was moving northward up the west coast of Greenland. Another large LOW moved northeastward off Nova Scotia and absorbed the circulation south of 55°N.

The LOW was over Davis Strait on the 7th. It generated 45-kn winds on the icecap. The FRITHJOF was near Godthab with 72-kn downslope winds and 23-ft waves. The DISKO was west of Kap Farvel with 44-kn winds. The storm continued northward over Baffin Bay and then turned southwestward over the islands.

This storm developed over the Gulf Coast on the 4th. On the 5th it was traveling northeastward along the Gulf Stream. The GYPSUM COUNTESS (40°N, 72°W) had 45-kn winds from the northeast. Other ships reported gales. At 1200 on the 6th the storm was 984 mb near 41°N, 58°W. The ships with the highest wind and wave reports were the EL PASO SOUTHERN (35°N, 64°W) with 50 kn and 41 ft, while the MANHATTAN DUKE measured 60 kn and 31 ft. Late that day another LOW developed in a trough of this circulation and sped off to the east as this one raced northeastward. On the 7th a ship near 45°N, 43°W, found 50-kn northerly winds with 20-ft waves. Charlie measured 40 kn with 20-ft seas. The storm was nearing the King Frederik coast of Greenland on the 8th. Lima was now under its influence and measured 50-kn winds. There was a 25-ft wave report at 45°N, 40°W. At 1800 the BERGLIND (57°N, 36°W) was on the 990 isobar with 63-kn winds. On the 9th a storm out of Quebec added a shot of energy to this storm as it was absorbed. The BILDERDYK was near latitude 51°N on the 10th with 45-kn winds. Charlie had 20-ft waves. The LOW had stalled near 62°N, 40°W, on the 8th. It was now deteriorating rapidly and disappeared on the 12th.

A frontal wave developed on the front out of the above storm on the 8th. It started and ended with a bang, but there was not much in between. The INCOTRANS SPEED (33°N, 43°W) was west of the 1006-mb center with 45-kn winds and 20-ft waves. A ship north of the center and front in the northerly flow had 36-ft swell waves.

On the 9th the pressure increased and there were only minimal gales. The LOW wandered northwestward and almost disappeared on the 11th, but a cold front from another LOW brought new energy to the storm which started intensifying again on the 12th. The USNS COMET was west of the center with 44 kn at 1200 and 55 kn at 1800, while the waves were 20 ft and 23 ft. The 55 kn continued into the 13th.

At 2100 on the 12th and 0300 on the 13th the EL PASO ARZEW, about 150 mi south of the LOW, measured 80- and 78-kn winds. A ship 100 mi west had 60-kn winds. By noon at Greenwich the winds were about the same, but the waves had picked up. Ships in all quadrants had waves over 20 ft, and the CINULIA within 6 mb of the center on the eastern side had 36-ft waves.

The storm, blocked by two high-pressure cells to the north, was slowly weakening. There were still a few gales being reported and an occasional wave up to 20 ft on the 14th and 15th. An exception was the ARGONAUT southwest of the center who found 41-ft swells on the 15th. The LOW disappeared from the analysis on the 16th.

A front stretched across Florida into the Gulf of Mexico, and waves were moving along it starting on the 12th. On the 13th one of these was unstable. With the aid of energy from the Gulf Stream it started expanding. By the 15th the 1004-mb LOW was off Cape Hatteras. Several ships had gales over 40 kn, and the NANT (40°N, 70°W) had 60-kn northeasterlies. These increased to 65 kn on the 16th with 30-ft waves. By 1800 they had decreased to 40 kn, but the swells were still 30 ft. The NANT was doing a marvelous job of reporting. The AMERICAN LEGEND and the DEFIANCE both found 60-kn winds along 40°N at longitudes 62°W and 68°W, east and west of the center, respectively. The waves were 36 ft from the southeast and 46 ft from the north. The DEFIANCE's waves continued over 30 ft into the 17th.

At this time a cold HIGH was pushing eastward over Quebec and forced the storm eastward and then southeastward. Early on the 17th the ARGONAUT (38°N, 60°W) was treated to 68-kn winds but didn't venture out in the dark to check the waves. The NANT now had 59 kn and 30-ft swells.

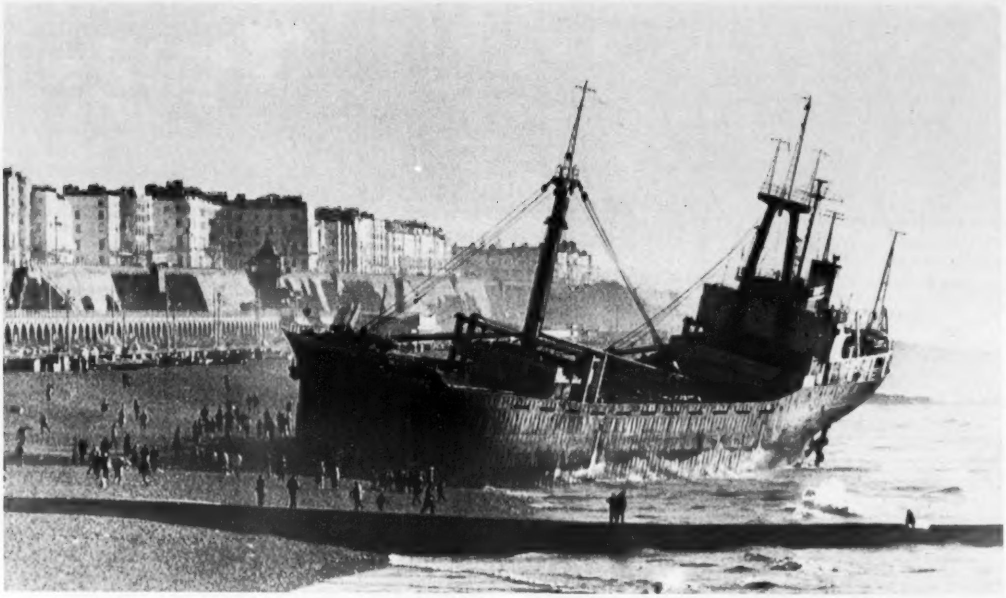


Figure 60.--Sightseers stroll the beach to view the 3,500-ton ATHINA B blown ashore in the storm. The crew fought 12 hr trying to keep the vessel aflost but finally were taken off by lifeboat. Wide World Photo.

On the 18th the central pressure was starting to increase and the gradient relaxed with a marked decrease in windspeeds. The LOW, now not a storm, continued drifting southeastward, then eastward to oblivion.

This storm had a long history and was the only one to come across southern Canada and survive to enter the Atlantic. It started its journey on the 13th over Lake Winnipeg. It crossed the Labrador coast on the 15th and was almost directly over Kap Farvel on the 16th. Its forward motion slowed, and the storm expanded. On the 18th winds over 40 kn were observed with Charlie measuring 45 kn with 23-ft seas. The persistent northwesterly winds were building the swell waves, and at 1800 Charlie had 30 ft.

On the 19th the LOW was 980 mb near 60°N, 26°W. The SELFOSS (66°N, 23°W) was being pounded by 52-kn winds. On the 20th the higher waves had arrived at Romeo at 20 ft. Late in the day a maverick LOW raced eastward along 52°N and wiped out this storm.

Although the storm changed centers, this LOW was a continuation of the total meteorological and storm system. On the 0000 analysis of the 20th a trough connected the above LOW with one off Nova Scotia. By the 1200 analysis a 984-mb LOW had formed in the trough and was traveling eastward. It was generating gales and 20-ft seas. On the 0000 chart of the 21st the LOW north of Romeo brought her 30-ft waves. At 1200 the 964-mb LOW was over the Irish Sea. The REGITZE THORSTRUP and the ATHINA B (fig. 60) both ran aground during the stormy weather. Forty- to fifty-knot winds and seas over 20 ft were common in the North Sea. The SOLON TURMAN in the Bay of Biscay radioed a 75-kn wind and 33-ft wave report. A ship near Lands End said the waves were 43 ft, and another in the Bay of Biscay called the waves 49 ft.

The storm had slowed in its northeasterly movement and was weakening on the 22d as it stalled near Edinburgh. By the 23d the weather had calmed to almost normal.

On the 22d a storm was moving across the Great Lakes. When it was near Ottawa a LOW formed off Cape Cod and preempted the circulation. At 1200 on the 24th the 964-mb storm was over Cabot Strait. The AUSTRAL PILOT (fig. 61) had 45-kn winds and 20-ft seas. She passed the front at 0300 on the 24th and a trough at 0600 on the 25th. The

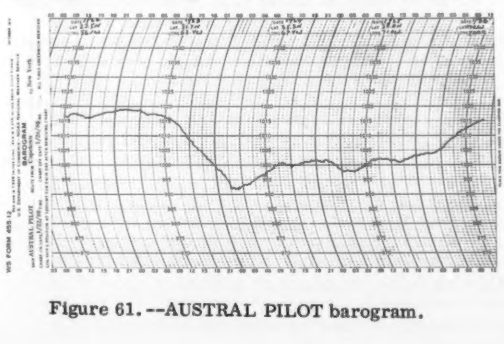


Figure 61.--AUSTRAL PILOT barogram.

ALGOSEA was off Delaware Bay with 52-kn winds. The JOHN CABOT off Cape Sable on the 25th had 73-kn westerlies and 34-ft seas. Later, two ships had 39-ft waves. At 1200 the central pressure hit a fantastic low pressure of 942 mb. The frontal system had moved ahead of the storm and was two-thirds of the way across the ocean. The circulation extended south to latitude 30°N and east to longitude 20°W. On the 26th the winds were basically 40 to 50 kn, but the PIONEER CONTENDER (41°N, 65°W) found 68 kn. A ship near 47°N, 52°W, had 38-ft seas.

On the 27th small LOWs started forming in the vast circulation. This broke up the symmetry of the system and started the decay process. The PIONEER CONTENDER still located 58-kn winds, and other ships found seas over 30 ft. The central pressure was building and relaxing the gradient, but there were still swell waves up to 30 ft far southeast of the center. The LOW had been meandering in the area of 55°N, 50°W, and disappeared late on the 30th.

This was one of the LOWs associated with the breakdown of the storm above. It traveled along the Gulf Coast as a frontal wave, continued eastward along latitude 35°N, and then turned northeastward on the 29th. It was still only a minor disturbance, but late on the 30th it exploded off the Bay of Biscay. It deepened 20 mb in 24 hr. At 1200 on the 31st it was 974 mb over the Irish Sea. There were many reports south to Cabo Finisterre of winds over 50 kn. The PRINCESS ANNE took the prize though with 65 kn near Lands End. Her waves were 33 ft. The C.S. ALERT, 180 mi to the south, had 33-ft seas and 49-ft swells. By February 1, the storm was over the Baltic Sea and no ship reports were available. Three ships received damage in the Bay of Biscay--the ATLAS, DANIA, and OCEAN ENDURANCE.

Along with the small LOWs and frontal waves rotating through and around the large storm centered north of Newfoundland were trough lines. As one of these swept eastward on the 29th, part of the trough was left behind, and a center formed near 35°N, 65°W. It was 988 mb at 0000 on the 31st and 964 mb at 1200 near 49°N, 42°W. The NURNBERG EXPRESS (47°N, 40°W) with a pressure of 971 mb was braving 64-kn winds and 36-ft waves. Another ship closer to the center had only 30 kn. On February 1, the BASHKIR (51°N, 37°W) supported 62-kn winds and 39-ft seas. Of the reports at 0600, and generally they are scarce, four had wave reports of 30 ft or more. Late on the 1st the storm weakened, and by the 3d it was gone.

Casualties--The following ships encountered heavy weather and suffered damage during the first part of the month: the BILL CROSBIE, DR. ADNAN BIREN, EASTERN TRADER, EN GEDI, FOREST STREAM, GENCLIK, IRISH OAK, KING RICHARD, MARIA P. MILOS MATIJEVIC, NEDA, OCEANIC WINNER, SALISTE, SALTERSGATE, SPRAGUE CAPELIA, and the STOLT FILIA. Eight crewmen abandoned the tug A.W. GUILL when its steering failed and a 456-ft container barge slammed into it off Cape Hatteras. The crewmen spent nearly 5 hr in a liferaft buffeted by 30-ft waves. On the 10th the FEDERAL ST. LAURENT at Quebec was unable to use her anchors due to icing. The research vessel ICE LADY was blown aground off of Tromso on the 15th. Four of five crewmen died when their liferaft capsized.

On the 4th the 10,076-ton BUENOS AIRES II and the DIRA RIPARIA collided in fog off Helegoland Island. Two crewmen were missing. The ORWELL FISHER (1,374 tons) and the PINEWOOD (1,599 tons) collided in thick fog near Belfast on the 11th. Other collisions in fog included the ELAN and TEKA and the NEREIDA and WYSPIANSKI in Brunsbuttel Harbor on the 16th and the BRISAS DEL NORTE and the NONI off Santona. The 24,332-ton empty tanker CEPHALONIA gored the 3,901-ton freighter LORD FRONTENAC in fog 5 mi off Galveston Bay on the 22d.

The 18,000-ton Liberian STAR CLIPPER rammed into the Alno Bridge, which is 30 mi north of Gothenburg, in dense fog on the 18th. The entire 500-yd-long span collapsed. Six cars and one truck fell over the edge before the bridge could be closed. Eight lives were lost.

The tanker TEXACO CARDIFF rescued eight crewmen from the CARMEN R. after her cargo shifted and she foundered in heavy weather near 12°N, 74.5°W. The 573-ton British SWITHA grounded on rocks near 56°N, 03°W, on the 31st.

Other Casualties--The 1,397-ton PEP ICE ran aground on a reef in Mozambique Channel, and stormy conditions hampered rescue of the crew. A rescue lifeboat was swamped, and the nine men were rescued by the PEP ICE. The research vessel SEISMIC EXPLORER lost 3,400 feet of floating cable 65 mi off Rio Gallegos, Argentina, in force 9 to 10 winds. The two 22,092-ton tank barges CLYTIA and MICHAEL CARRAS broke tow near La Reunion on the 27th and were adrift.

SMOOTH LOG, FEBRUARY 1980--The primary path of this month's storms originated off the U.S. East Coast and tracked northeastward toward Iceland following a climatological track. A climatological track across the Great Lakes was diffuse and did not extend into Baffin Bay as it should have. A secondary track eastward across the United Kingdom was present as predicted. The Mediterranean was quieter than it should have been.

The mean sea-level pressure pattern could have been traced from the climatological pattern, except for central pressures. The Icelandic Low at 992 mb

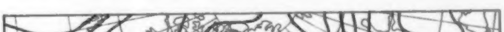


Figure 62.--Mean sea-level pressure chart.

was about 175 mi southeast of Kap Farvel (58°N,40°W). The climatic position at 1003 mb is 60°N, 37°W. A trough connected the primary LOW to a secondary 1006-mb LOW near Spitsbergen. The Azores High at 1024 mb was near 33°N, 26°W. Climatology shows it to be 1020 mb near 30°N, 30°W. A series of three shallow LOWs over the northern Mediterranean Sea was not present this month (fig. 62).

The principal anomaly center associated with the weather this month was minus 12 mb south of Kap Farvel. This was to a large extent the result of lower pressures rather than placement. There was a minus 10-mb center over northern Greenland and a plus 10-mb center over the Baltic Sea.

In the upper air at 700 mb the primary flow was eastward off the North American coast; it gradually turned northeastward over the eastern ocean. The primary LOW usually over Devon Island was split into two centers, one near the Pole and the other near Kap Farvel. This helps to explain the sparsity of storms along the west coast of Greenland.

Extratropical Cyclones--In flipping through the charts like a motion picture projector there is a continuing flow of low-pressure centers from east of Cape Hatteras to Iceland. The Azores High was well established, but it oscillated from south of the Azores to west of the Bay of Biscay depending on the strength and location of the LOW(s).

Early on the 2d a LOW formed in a trough left behind by a previous LOW. It quickly pulled the attendant front into its circulation. At 1200 a ship reported 25-ft swell waves in the continuing northwesterly flow southwest of the center. At 0000 on the 3d the C.V. STAGHOUND (39°N, 54°W) found 50-kn winds after the storm passed very near her about 4 hr earlier. By 1200 the storm was 976 mb near 47°N, 42°W. It was not exceptionally large, but it was generating strong winds and high waves. Several ships were finding winds near or over 60 kn. The W.C. VAN HORNE (33°N, 52°W) had 67-kn southwesterly winds and 20-ft waves. Near 42°N, 42°W, a German ship had 64-kn winds with 43-ft swell waves. At 1800 the KATENDRECHT (46°N, 36°W) estimated 64-kn winds out of the southwest and 57-ft waves. At 0600 on the 4th she reported 48-kn winds and 39-ft seas 20 mi farther south. Other ships in the corridor of 10° to 20°W were reporting winds in the 50-kn range and waves of 25 to 33 ft. The AUSTRAL ENDURANCE had 33-ft swell waves (fig. 63). On the 5th the storm moved over the United Kingdom with the winds decreasing to the 40's and the waves generally below 25 ft, but the MANNHEIM off Brest still had 33-ft swells.

The trawler CORDEIRO DE DEUS sank in high seas off the north coast of Portugal, and the fishing vessel FRANCISCO DUQUE was missing. The 23,207-ton IRVING ARCTIC lost a six-man liferaft overboard near 49°N, 15°W. As the storm moved over the North Sea, another roared in and absorbed it.

Early on the 4th there was a col area of weak gradient south of Bermuda. By 1200 an inverted trough had formed with a 1009-mb LOW. An upper air trough was sweeping eastward, and the storm was picked up in its northeasterly flow and developed rapidly. By 1800 on the 5th winds of 50 kn had been generated.

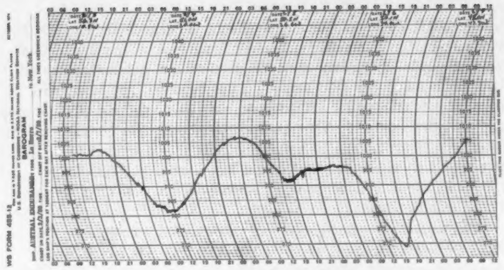


Figure 63. --Barogram of the AUSTRAL ENDURANCE.

The EXPORT CHALLENGER (39°N, 42°W) found 52-kn winds. The SEIKOU MARU and TROLL LAKE both had waves over 30 ft. At 1200 on the 6th the 972-mb storm was near 47°N, 42°W. The SEA-LAND RESOURCE (42°N, 41°W) had 50-kn winds and 36-ft swells. The SNOW LAND had 64-kn winds and 26-ft waves west of the occlusion at 1800. On the 7th there were several reports of winds of 60 kn and many in the 50-kn range. Wave reports of over 30 ft were also common. The CAST DOLPHIN (51°N, 24°W) had some of the more severe weather with 60-kn winds and 49-ft swell waves. The 1,500-ton SEATRAIN LEONOR arrived Key West with four containers lost overboard and three damaged.

On the 0000 analysis of the 8th this storm stretched from France to Labrador and Iceland to 30°N. Stronger winds were now north of the center, and the Icelandic fishing fleet was being hit by winds up to 60 kn. Most do not report waves, but OWS Lima had 26-ft waves. Another severe storm was moving eastward south of Nova Scotia. On the 9th the high winds and waves had hit the North Sea, and two ships west of the center had 60 kn. On the 10th the new storm squeezed this one out of existence. The 18,000-ton MARGARITA encountered heavy weather on the 7th to the 11th out of Philadelphia, probably from this and the next storm.

Monster of the Month--This potential storm was spawned off Savannah, Ga., on the 6th. At 0600 on the 7th a U.S. ship off Norfolk had 60 kn winds. Later in the day the SEA-LAND CONSUMER had winds of 55 kn and waves of 30 ft. At 1900 the COLORADO (41°N, 69°W) took a special observation for waves of 41 ft. At 1200 on the 8th the 978-mb storm was near 40°N, 62°W. There were many 40- to 60-kn winds and high wave reports. The VIANA (33°N, 69°W) found 43-ft waves. The

11,249-ton MARIA S. reported damage to her bow and a hatch to the Coast Guard. The vessel was proceeding downsea to ride out the storm. The 33,329-ton AL-VENUS suffered damage transiting this storm. Four sailors were washed overboard from the USS KING while about 50 mi northeast of Cape Hatteras. Only one was rescued. At 1800 the GARTHNEWYDD (38°N, 47°W) was hove to in 50-kn winds. Twenty-four hours later she still had 55-kn winds with 41-ft swells and had only traveled about 85 mi.

The 9th was really a bad day to be out. There were a half a dozen reports of winds of 60 kn or greater and two reports of 59-ft swell waves. There were also 46- and 39-ft swell reports. These were south of the center in the vicinity of 35°N, 50°W. At 0000 on the 10th the STRATHDEVON was near 35°N, 54°W, and finding 52-ft swell waves. Later in the day the winds and waves decreased somewhat, but the KING RICHARD (39°N, 41°W) still found 57-kn winds and 36-ft waves.

On the 11th the storm was decaying rapidly with maximum winds in the 40-kn and waves in the 20-ft categories. The storm was traveling northward, but on the 12th it broke away from the upper-air center and raced northeastward.

This was the fourth strong storm in about a week to generate off the U.S. East Coast. This was another case of a frontal wave developing over the Gulf Stream off Cape Hatteras. In 12 hr the storm plunged from 1000 to 980 mb. The STRATHDEVON was running from one storm into the next on her westward course. At 0000 on the 11th her winds were only 40 kn out of the southwest near 36°N, 58°W, but the swell waves were 33 ft from the northeast. This direction was verified by another ship in the vicinity. By 1200 the storm had dropped another 21 mb in pressure to 959 mb near 43°N, 55°W. Two ships now had 70-kn winds--the ATLANTIC CAUSEWAY (41°N, 60°W) with 43-ft waves and the JALAKIRTI (42°N, 55°W) with no wave report. The CHALMETTE (40°N, 51°W) also had 43-ft swell waves. At 1800 the CARCHESTER radioed 90-kn winds and 80-kn winds at 0000 on the 12th near 43°N, 51°W. By 0600 they had dropped to 50 kn, but she was reporting 57-ft swell waves. Wind reports over 60 kn continued the rest of the day with waves over 30 ft. The AMERICAN ACE (43°N, 45°W) took a 1000 special observation of 65 kn and 41 ft. On the 13th the DUNELMIA (48°N, 39°W) was still locating 60-kn winds and 57-ft waves. The winds decreased slightly at 0600 but the seas were still pounding the 49-ft line. The ALDGATE joined with winds over 60 kn at 0600 and 1200, but her waves were only 36 ft. Late in the day a LOW out of Cape Cod raced into the circulation and took over as the first one lost its upper-level support.

This new center stalled near 54°N, 44°W, on the 14th and 15th, while the pressure dropped to 960 mb. On the 14th the ALDGATE still was reporting 60-kn winds, but the waves had quieted to 26 ft. The SAGITTA MARIS was far north in the Denmark Strait with 60-kn easterly winds and 23-ft seas. The YOUNG AMERICA (43°N, 38°W) found 50-kn winds and 33-ft waves on the 15th. The storm covered and influenced most of the Atlantic north of latitude 30°N. The exception was an area off the East Coast south of Long Island. Some swell waves up to 30 ft were being reported as far south as 35°N.

On the 16th the storm started weakening with only gale-strength winds, but swell waves over 25 ft were still being found. Two ships near 45°N had waves over 35 ft.

The 5,466-ton ATLANTIC PROSPER and the 10,249-ton EVER SPLENDOR probably suffered their heavy-weather damage with this storm.

This frontal wave came out of the Straits of Florida on the 19th. It traveled over the warmer water east of the Gulf Stream. A ship south of the center found 40-kn winds and 25-ft waves on the 20th. At 1200 on the 21st the 984-mb storm was near 41°N, 58°W. There were several reports of 40- to 45-kn winds. At 1800 the ADM. WM. M. CALLAGHAN (37°N, 58°W) was in the southwest quadrant with westerly 70-kn winds, 25-ft seas, and 44-ft swells.

On the 22d this LOW died as another center formed about 500 mi to the northeast. The NEDLLOYD ROCHESTER (40°N, 56°W) had 56-kn winds as the cold front passed. Charlie had 20-ft seas. At 1200 the storm was 960 mb near 56°N, 40°W. The ARGONAUT (38°N, 47°W) over 1,000 mi to the south had her bow into 68-kn westerly winds driving 20-ft seas, and 36-ft swells. The SEA LAND CONSUMER had 55 kn and the CAST BEAVER (46°N, 33°W) had 30-ft seas and 39-ft swells hammering her starboard side. On the 23d OWS Charlie had seas between 20 and 30 ft with winds measured at over 45 kn. Lima also measured winds over 40 kn and waves over 25 ft. A Danish ship had 50-kn winds near 59°N, 35°W, on the 24th, while Charlie still had 30-ft swell waves. The LOW was moving up the east coast of Greenland where it vanished.

As the last storm dissipated it left the weather over the ocean diffuse with many small centers. On the 0000 analysis of the 25th a new LOW center was found south of Cape Race. At 1200 on the 26th OWS Charlie measured 52-kn winds and 30-ft seas as the front passed. The LOW was 992 mb southeast of Kap Farvel.

On the 27th the storm was over Iceland. A Danish ship south of the island at 61°N had 50-kn winds and 26-ft seas. The VIGRI southwest of Keflavik reported 68-kn winds. Most of the fishing fleet was reporting winds near 45 kn, but the DETTIFOSS (63°N, 18°W) had 60 kn. The storm was moving over the Norwegian Sea on the 28th. A ship off the coast of Norway reported 36-ft seas.

This was a dual-center storm at first. This LOW formed off Norfolk southwest of an existing LOW on the 26th. There was an isolated 40-kn wind and 20-ft wave report. By the 27th there were many winds above 40 kn. The DALLIA (38°N, 71°W) had 53-kn winds and 30-ft seas, while another ship near 35°N, 65°W, had 50-kn and 33-ft seas. On the 1200 analysis the northern center had disappeared and the storm was 972 mb over Cape Race. The CARCHESTER (42°N, 55°W) had 50-kn winds and 39-ft waves. Many ships had 40- to 50-kn winds and seas and swells of 30 ft.

On the 28th the ships east and north of Cape Race had a rough time. The MANCHESTER CONCEPT (47°N, 50°W) had 41-ft swells. The HUDSON (48°N, 45°W) had 50-kn winds, 34-ft seas, and 52-ft swells. The OSA OSTEND (47°N, 49°W) found 45 kn with 23-ft seas and 46-ft swells. The FRITHJOF (59°N, 45°W) was contending with 72-kn northeasterlies and 30-ft seas. At 1200 the winds were still 68 kn with 39-ft seas. On the 29th the storm broke up on the south tip of Greenland.

Casualties--The 6,029-ton EXTRACO 2 contacted the pier while berthing at Spezia in heavy weather on the 1st. The NEWHAVEN on a voyage to Greece from the 1st to the 19th reported weather damage. The 22,357-ton CHERRY VALLEY suffered weather damage during the 9th to the 12th on a voyage from Curacao to Holyrood. The OLYMPIA in ballast ran aground on the 13th at Amorgos Island while trying to shelter on the lee side of Gamboussa Islet during heavy weather. On the 16th four ships were involved in a collision in fog on the River Tagus. They were the BARRANDUNA, ENGENHEIRO ESPARGUEIRA, SERRA DE PORTALEGRE, and TOLLAN. The last one sank. On the 22d the 666-ton SATURNUS struck rocks near Bressay Light in force 8 to 9 gales, 1/2-mi visibility, and heavy rain. On the 24th the MEGALOHARI II in ballast went aground off Laurium in gale-force winds. The Panamanian SEVERN lost a spare propeller overboard during bad weather.

The following ships suffered ice or ice-related damage: BALTIMORE, EERBECK, EEMS BORG, NEDLLOYD 21, and SIBRIS.

Smooth Log, North Pacific Weather

January and February 1980

SMOOTH LOG, JANUARY 1980--The cyclone tracks were scattered across the ocean after they turned northward or northeastward. The only favorite path was from Japan eastward prior to curvature.

The Aleutian Low at 998 mb was within 1 mb of climatology, but it was 10° latitude farther south than normal near 40°N, 180°. The Pacific High was 1017 mb near 25°N, 125°W, versus 1020 mb according to climatology and 300 mi southeast of its normal position (fig. 64).

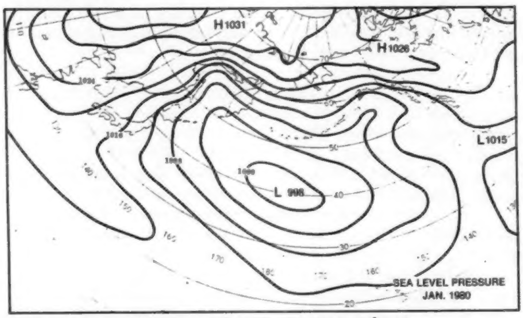


Figure 64. --Mean sea-level pressure chart.

There were four anomaly centers of importance. Two were negative and basically associated with the displacement of the Aleutian Low. One center was minus 9 mb near 39°N, 173°W, and the other was minus 10 mb near 35°N, 145°W. The two positive centers were plus 11 mb over eastern Siberia and plus 4 mb over the Gulf of Alaska near 52°N, 140°W.

The upper-air flow at 700 mb was mainly zonal between latitudes 20° and 40°N from the Asian coast to about 170°W. The primary LOW was over the Sea of Okhotsk. The ridge that is normally over the North American west coast was shifted westward over the water.

Wave climatology shows an area of about 4° latitude and 15° longitude centered on 50°N and 165°E, where the probability of encountering waves of 12 ft or greater is 40 percent and of 20 ft or greater 10 percent.

Extratropical Cyclones--This LOW formed at the point of occlusion of a front east of Honshu. It intensified very rapidly, and by 1200 on the 5th ships were reporting high winds and waves. A Japanese ship near 34°N, 147°E, in the northerly flow had 40-kn winds and 33-ft waves. At 1200 the META had 45-kn southerly winds which had shifted to the north at 1800 at 55 kn with 33-ft seas and 39-ft swells.

There were three LOWs alined north-south at about longitude 160°E on the analysis of 0000 on the 6th, and this was the center one. A ship near 39°N, 164°E, had 50-kn winds with 30-ft seas and 33-ft swells. The PRESIDENT JEFFERSON was east of the front connecting the three LOWs with 50-kn southerly winds and waves of 20 and 23 ft. By the 1200 analysis this LOW had been squeezed out between two high-pressure cells.

As the above LOW disappeared, the southern one became the storm to contend with. At 1200 on the 6th the PACIFIC VENTURE measured 55-kn winds and 25-ft waves. At 0000 on the 7th it was 994 mb at 33°N, 174°E. There were high winds and waves on both sides of the front, which stretched north-south from 60°N to 15°N. The HOEGH MIRANDA measured 50-kn northwesterly winds and 26-ft seas northwest of the LOW, while a ship near 45°N, 167°E, had 36-ft waves from the east.

This was an odd storm that acted like a large frontal wave. The fronts across the ocean were different also as three of them looked like graceful "S" curves. High pressure was building over the Bering Sea--1048 mb on the 8th. The easterly flow south of this HIGH penetrated south of latitude 40°N. The SEAWAY CLIPPER, west of the storm, had 48-kn winds and 30-ft waves. On the 8th the storm died as another center formed farther to the east.

This storm center came into being as two others on each side deteriorated on the 8th. The SEAWAY DISPATCH near 30°N, 177°W, had gales of 45 kn and seas of 23 ft. By 1200 on the 9th the storm was 978 mb near 34°N, 160°W. The strong circulation south of the center brought high winds and large amounts of rain to the Hawaiian Islands. Though ship reports did not reflect the high winds, there were reports of hurricane-force winds in the Islands and over 20 in of rain. The higher winds may have been partly caused by funneling effects and on mountains. It was reported that trees were uprooted with damage to

electric and telephone services. The storm was directly responsible for seven deaths, two in the crash of a cargo plane in Honolulu and three on the island of Hawaii. Twenty-foot waves pounded the south and west shores. Boats were damaged and swamped and shore homes damaged. The highest wind report by a ship in the vicinity of the Islands was 45 kn by the VELMA LYKES on the 10th. That day the storm was moving northward against the strong easterly flow from the large HIGH, which was now centered over the Arctic Ocean. Several ships northeast of the center had 40- to 50-kn winds with waves to 30 ft. By the 11th the storm had disappeared as a frontal wave arrived from the northwest to continue the overall cyclonic circulation.

For additional information on this storm's affect on Hawaii, see the article "Winter Storm near Hawaii" on page 261.

This storm squeezed into the Pacific Northwest between two large high-pressure cells, one over the Yukon Territory and the other off Vancouver Island. The LOW moved southeastward along the coast out of the Gulf of Alaska and was over Vancouver Island on the 8th at 1006 mb. It was not a deep storm, but it dumped up to 14 in of snow along the Oregon-Washington coasts. It came close to paralyzing Seattle and Portland. Many roads were closed and motorists stranded. It was reported that 125 small boats sank, and numerous roofs collapsed. Rain in southern California caused mudslides and flooding. The PRESIDENT MADISON found 50-kn winds from the northeast near 53°N, 142°W. Early on the 10th the LOW moved inland.

This LOW formed on the 8th near 38°N, 163°E. It moved into the circulation of the storm that hit Hawaii and reinforced it. On the 8th and 9th the winds with the storm were not so high, but there were many wave reports of 20 ft or greater. Among others the WORLD PRIDE at 36°N, 153°-158°E, had winds of only gale strength, but the waves were reported as up to 57 ft on the 8th and 9th. The HOHSING ARROW measured 55-kn winds and 33-ft waves. The ESSO PROVIDENCE at 42°N, 158°E, was no piker in reporting 46-ft swells.

The LOW was near 33°N, 170°W, at 1200 on the 10th at 976 mb. There were winds up to 55 kn associated with it. The PORT VANCOUVER (34°N, 175°E) had 45-kn gales and 33-ft waves on the 11th. The KISO MARU found 52-kn winds and 23-ft waves. Early on the 12th the ANCO EMPRESS was sailing southwestward into 50-kn winds and 20-ft waves. At 0600 on the 12th the SEA-LAND MCLEAN must have passed directly through the center with a pressure of 955 mb. The LOW disappeared a few hours later as a large storm built over the Gulf of Alaska.

This storm formed in an inverted trough off Kyushu on the 9th. By the 10th there were mainly gales, but the SEATRAIN CHESAPEAKE (35°N, 147°E) was within 4 mb of the center of the 984-mb storm and measured 65 kn easterly winds in a special observation at 0500. Thirteen hours later the SEATRAIN YORKTOWN also measured 65-kn winds and 987 mb south of the center with 39-ft waves. On the 11th the waves had built to 43 ft as attested to by the YORKTOWN and the NORSE PILOT. They had 60- and 48-kn winds, respectively. At 0000 on the 12th the LOW was 976 mb near 40°N, 163°E. The PENNSYLVANIA RAINBOW was not far away near 37°N, 162°E, with winds of 60 kn, seas of 20 ft, and swells to 36 ft. At 0600 the swells increased to 46 ft. On the 13th it was the PORT VANCOUVER's turn to battle 44-ft swell waves near 34°N, 168°E. The waves in the southwest quadrant were holding better than the winds. On the 15th the LOW was weakening, but 20- to 30-ft swells persisted. On the 16th it finally gave up.

This LOW formed over the Gulf of Alaska on the 10th in the wake of the storm that brought all the snow to the Pacific Northwest. By the 0000 report of the 11th ships between 49°N and 55°N near the coast were reporting strong gales with waves near 25 ft. On the 12th the CGC CLOVER near Cape Flattery had 60-kn winds and 20-ft waves from the southeast. At 1800 that day OWS Papa measured 68-kn winds. Stations on the British Columbia coast were measuring over 40-kn winds. The gradient was tightest over the mountains.

On the 12th another LOW moved into Queen Charlotte Sound and absorbed the first one. This one brought 60 mi/h wind gusts along the coast from northern California to Washington. The MOBIL MERIDIAN had 50-kn winds but only 15-ft waves off Port Alice on the 13th. As this storm moved inland, yet another LOW formed near Kodiak Island. The pressure was 962 mb at 1200. Cape St. James measured 40-kn winds. The SOUTH EXPRESS (53°N, 146°W) measured only 40-kn winds, but the waves were 33 ft. Northwesterly winds had been blowing across the Alaska Peninsula for nearly a week bringing extremely cold air south of the peninsula. On the 14th the 110-ft crab fishing boat GEMINI ran into 15-ft seas, gale-force northwesterly winds, and heavy freezing spray. Early on the 15th the ship capsized and sank because of ice accumulation on the superstructure. Two of the crew were lost, one suffered severe hypothermia, and two were saved after drifting in a liferaft for over 100 hr.

This LOW remained nearly stationary until it disappeared on the 17th.

This storm formed on the 15th in a trough associated with a LOW that moved northward over the Kurile Islands. By 1200 a ship about 400 mi to the southwest found 26-ft swell waves. By 1200 on the 16th the 966-mb storm was near 45°N, 178°W. The ALCYONE (40°N, 171°E) had 60-kn winds with no wave report, but she later reported weather damage. The DIAMOND PHOENIX (41°N, 176°E) had 54 kn and 30-ft seas. The latter ship's winds continued over 50 kn until the 17th, and she now had 39-ft seas. At 1200 the winds were 45 kn and the seas 33 ft. She was traveling with the storm at about the same speed and relative position to the center.

The LOW had turned northeastward and left most of the stronger winds south of latitude 40°N and east of the front. A strong HIGH was over British Columbia bringing strong southerly flow between the two centers. The SANKO MARU was one of the southern ships with 45-kn winds, 33-ft seas, and 49-ft swells. Several other ships had waves of 20 to 25 ft. The OCEAN DUKE (53°N, 152°W) was in the southerly flow with 50 kn and 30-ft waves. On the 18th a small LOW split off north of this one and continued

northward, while this storm curved southeastward to disappear.

The small LOW wrought havoc over the Kenai Peninsula and to Anchorage. At 1200 on the 18th it was over Bristol Bay with the strong gradient to the east. It brought storm-force winds inland. Peak winds of 85 kn were measured in the eastern part of Anchorage and the foothills of the Chugach Mountains. There were power outages, damage to homes and mobile homes, and small aircraft. Roads were closed because of avalanches and icy roads. Most schools were closed. The storm moved over the Bering Strait on the 19th and was no more danger.

This LOW came out of China as a 1022-mb indentation in a 1041-mb HIGH. It gained strength as it moved over the Sea of Japan. On the 17th the TOYOTA MARU No. 11 had 30-ft swells near 34°N, 147°E, just east of the cold front. Twelve hours later a ship in the same relative position to the front had 28-ft waves. The SEA-LAND ADVENTURER was some 600 mi southwest of the center with 58-kn winds.

The LOW traveled almost due east. At 1200 on the 18th it was 984 mb near 41°N, 167°E. The winds were in the 40-kn range, but the waves were raging to 30 ft and more. On the 19th two ships had winds near 60 kn west of the center. Twenty- to thirty-foot waves were common.

On the 20th the storm started curving northward. The BONNIEWAY (39°N, 177°E) had crossed north of the storm and had 55-kn winds about 900 mi southwest of its center. The CGC RUSH was riding 55-kn easterly winds near 54°N, 159°W. The storm crossed the Alaska Peninsula late in the day and finally was lost on the North Slope. As a parting gesture, it left 49-ft waves behind, which the SANKOSTAR found near 51°N, 159°W.

This was another LOW that developed at the frontal occlusion. A fair-sized storm with gales was moving northeastward along the Kurile Islands. The frontal system had rotated some distance to the east of the storm. The 1200 chart of the 23d first indicated the new closed circulation. At that time a SHIP about 300 mi east of the new center (981 mb) indicated 55-kn winds.

Within 12 hr the new storm (965 mb) was deeper than the parent one. The SEA-LAND FINANCE (50°N, 165°W) was in 60-kn southeasterly winds with 20-ft waves. Another ship, the H8DF, found 26-ft waves near the new point of occlusion. Nine other ships had winds over 40 kn.

Early on the 25th the storm was about to move ashore on Siberia as three ships were still reporting swells over 23 ft. Later in the day this storm dissipated as another moved into the area.

As a LOW moved northward over Kamchatka it left an area of weak gradient to the south. This could not last long as nature is prone to change things. A closed LOW was found at 0000 on the 27th. At 1200 it wasn't much of a storm, but by 0000 on the 28th things had changed. The pressure had dropped to 976 mb. The surface storm had become alined with an upper-air cutoff LOW and was now a complete system. The winds were in the 40's, but two ships, the SURUGA MARU and TYSON LYKES in the vicinity of 28°N, 173°E, both found 30-ft waves out of the northwest. The LOW had originally moved southeastward but had turned northeastward. Later in the day the NISSAN MARU (33°N, 172°E) had 60-kn winds, and the ARNOLD MAERSK (38°N, 175°W) had northeasterly 70-kn winds. On the 29th the SEA-TRAIN PRINCETON (30°N, 173°W) was contending with 64 kn. The seas were generally up to 20 ft, but the SEA-LAND PIONEER (33°N, 172°E) found 30-ft swells.

The higher winds continued around 40 kn and the waves 20 ft as the storm continued toward the Gulf of Alaska. Some of the higher waves were now in the northwest quadrant near the Aleutians. The storm's cyclonic circulation now covered most of the northeast quarter of the ocean. On the 31st the ASIA BOTAN (48°N, 143°W) said the winds were 68 kn and the waves 30 ft. At 1200 a ship reported 60-kn winds and 62-ft waves near Vandura, Saskatchewan, Canada. At 1800 the report from Papa indicated 82 kn, but I question that speed. Her pressure was 972.8 mb near the 965-mb center, and the rest of the observation appears good. On the 1800/01 and 0000/02 reports a SHIP indicated near 60-kn winds within 4 mb of the center, so Papa may have been right. Her waves were 31 ft.

On the 2d a following LOW became the circulation center and on the 3d yet another. On the 4th another storm moved in.

From small frontal waves, large storms grow. This was the case of this small wave on a front south of Kyushu on the 29th. By 1200 on the 30th the 981-mb storm was northeast of Tokyo with a secondary center over the Sea of Japan. Several ships reported high gales, including the THANA VAREE (41°N, 150°E). On the 31st a Japanese ship (45°N, 159°E) encountered 53-kn easterly winds and 20-ft waves. Closer to the islands the 5,130-ton HATSUFUJI sank in heavy seas in the Sea of Japan after taking on water. One crewman was rescued. The motorvessel SHINEI MARU sank in blizzard conditions, again only one crewman was rescued (fig. 65). A ship south of the storm had 30 ft waves. The ALSTER EXPRESS (48°N, 157°E) was many miles to the northeast with 52-kn winds and 30-ft seas from the east.

On February 1 the gravel carrier TAISEI MARU capsized in Osaka Bay. The 2,993-ton FLAMINGO had a 20-degree list south of Tokyo in heavy seas. The CYNTHIA G. out of Yokohama with 2,000 tons of steel had a heavy list and engine trouble after cargo storage collapsed in heavy weather. The crew was rescued by helicopter.

The storm center continued northward, but another LOW developed to the south and ships in that area were pounded with strong gales and waves of 20 to 35 ft. These continued into the 2d, but by the 3d the weather moderated, and by the 4th the LOW was only a trough.

Casualties--The yacht GOOD SHIP INDIA sank in heavy weather on the 1st in the Mediterranean. Six persons were rescued by the STAHLECK. Two barges towed by the tug MOANA HOLO parted their towline during heavy weather on the 5th about 1,200 mi from Honolulu and collided. The AGIOS GIORGIS sank in heavy seas about 560 mi east of Tokyo. No trace was found of the 29 people on board, although lifeboats were reported as being launched. The 33,461-ton Korean HONGJIN was reportedly listing badly in stormy seas on the 10th. The 3,429-

Figure 65.--A Japanese military helicopter lifts a crewman from the SHINEI MARU after the cargo shifted in rough seas. Tokyo Shimbun Photo.

ton GRAND UNION had heavy-weather damage during the 7th to the 12th.

The two Korean fishing vessels GAE YANG and GAE CHEONG HO No. 2 were trapped in ice near St. Matthew Island in the Bering Sea on the 14th. The cutter STORIS went to the rescue. The 3,618-ton KINBALU TIGA ran aground on rocks in bad weather near 44°N, 14: E, on the 15th. The crew was rescued by helicopter. The fishing vessel GEMINI was reported sunk near 56°N, 148°W, on the 16th from the buildup of heavy ice. The 2,992-ton ALEX sank in the Sea of Japan on the 22d after being washed by a high wave. Only 2 of 21 crewmembers were rescued. The NGTRANS II sank off Malaysia in heavy weather the night of the 26th. The 3,197-ton Korean VICTORY MARCH was last heard from on the 29th near 27°N, 123°E. She was encountering heavy weather and leaking. None of the crew of 24 was found.

The following ships also had heavy-weather damage: ALCYONE, CHU FUJINO, HAN WOO, NIHON ALPHA, OGDEN THAMES, and SOUTH GLORY. The ANCO CHARGER received flooding in heavy weather off Australia.

SMOOTH LOG, FEBRUARY 1980--The main storm track was started as a thin stream off Tokyo and spread eastward between latitudes 35° and 45°N. There were individual tracks which sprayed off to the north all along the main stream, as there were new storms that formed and old ones disappeared. As the stream neared the U.S. West Coast, nearly all storms turned northward. The climatic pattern shows a more broken pattern with a cyclonic curvature to the tracks over midocean rather than a general anticyclonic curvature overall this month.

The overall mean sea-level pressure pattern was very similar to the climatic mean, except more intense with centers shifted. As would be expected, the Aleutian Low was the major feature over the water at 990 mb near 46°N, 167°W. This contrasts to a normal 999-mb center near 50°N, 180°. The Pacific High at 1018 mb was shifted some 700 mi southeastward to near 24°N, 120°W. High pressure over continental North America was about 4 mb higher than normal, and the large Asia High was 7 mb above normal at 1041 mb (fig. 66).

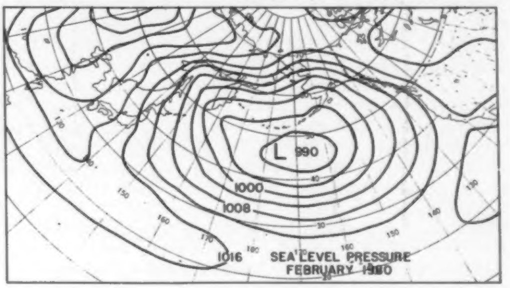


Figure 66.--Mean sea-level pressure chart.

The only significant anomaly was a large -18 mb one that basically dominated and covered the ocean north of latitude 20°N, except south and west of Japan.

The upper-air pattern at 700 mb closely resembled climatology, with the primary LOW near Kamchatka and zonal flow between 25° and 50°N latitude from the Asian coast to longitude 160°W. There was an anomalous secondary LOW near Adak Island, and the height lines turned sharply northward south of Alaska to produce a much sharper ridge than normal over the North American west coast. This produced a deep negative anomaly center north of Hawaii with a large positive anomaly center over northern Canada. This was reflected in the sharp northerly curve of the storm tracks south of the Gulf of Alaska.

There were no tropical cyclones this month.

Extratropical Cyclones--This was one of the LOWs mentioned in the January Log. At 0000 on the 1st it was 995 mb near 38°N, 150°E. By 1200 there were gales in the southwest quadrant. The SEA-LAND PIONEER (35°N, 149°E) measured 48-kn winds with 26-ft waves. Late on the 1st and early on the 2d the PACIFIC SAGA was headed southwestward with 50-kn winds on her starboard bow. The waves were up to 20 ft. A ship south of the center had 36-ft swells. On the 2d the PAN PACIFIC had 65-kn winds. The storm was racing eastward. The PACIFIC VENTURE measured 59-kn winds with 30-ft waves on the 3d. The SEATRAIN YORKTOWN (33°N, 156°W) was the next

victim with 62-kn winds and 26-ft waves. Six hours later they were 55 kn and 33 ft as she traveled only two-tenths of a degree of longitude.

On the 5th the storm was nearing the West Coast with a tight gradient and strong southerly winds along the coast. It also had turned to the north toward Kodiak Island. On the 6th the MOBILOIL measured 70-kn easterly winds and 20-ft seas south of Montague Island and reported them on a 0400 special observation. Eight hours later the ARCO ANCHORAGE was in the same area with 33-ft waves. The storm crossed the Alaska Peninsula late that day and was lost over the Alaska western coastal plain.

This storm sailed from Tokyo Bay early on the 4th. By the 6th the LOW had incorporated part of an old frontal system and had developed a strong circulation. The PRESIDENT WILSON, west of the center near 37°N, 147°E, had 50-kn winds with 15-ft waves. Nearby, the 8KWS had 25-ft waves. At 1200 the NELSON MARU (41°N, 160°E) had 60-kn winds from the north. The PACIFIC VENTURE (35°N, 158°E) was headed southwestward on the 6th and measured 74-kn winds driving 41-ft waves about 40° off her starboard bow. At least she was headed out of the worst weather, with reports of 54 kn and 28 ft on the 7th and 42 kn and 23 ft on the 8th. The SEA-LAND COMMERCE had 50-kn winds and 23-ft waves at 1800. The central pressure of the storm had dropped to 956 mb by 0000 on the 7th. The TONE MARU (45°N, 167°E), about 250 mi west of the center, had 30-ft waves. Far to the southwest the ANTON CHEKHOV reported 33-ft waves, and the PORT VANCOUVER (47°N, 177°W) 500 mi east of the center had 50-kn southeasterly winds and 36-ft swell waves. The SHUNWIND (37°N, 175°W) was 400 mi due south of the storm at 0600 and not shunning the wind very well. She measured 75-kn westerly winds, 33-ft seas, and 55-ft swells. The storm's influence stretched from Japan to 150°W and the Bering Sea to 25°N. At 1200 on the 7th the SEA-LAND COMMERCE registered a pressure of 946.5 mb, which reached 945.5 mb a few hours later. The ship was near 45°N, 180°. On the 8th her winds reached only 40 kn, but the swell waves hit 33 ft. The HOEGH MIRANDA and SHUNWIND now had 39- and 42-ft waves. The KASHU MARU reported the highest winds of 60 kn with 20-ft seas and 33-ft swells. Others had waves of 20 to 26 ft. The 110-ft crab fishing boat PACIFIC TRADER capsized and sank north of Unimak Island on the evening of the 7th. Three of five crewmen were lost. The central pressure was now 942 mb. The PORT VANCOUVER was paralleling the storm track and at 0000 on the 9th called the swell waves 43 ft. The storm was centered on Seguam Island, and its cyclonic circulation covered a large part of the central ocean. Far to the south at 31°N, 173°E, the QUEEN ELIZABETH II was plowing into 30-ft westerly swells. Many passengers must have been uncomfortable. The high waves continued through the day, but on the 10th the storm started breaking up into isolated LOWs, but it was still strong enough to take a 65-kn and 30-ft swipe at the PRESIDENT MADISON off the Kamchatka Peninsula.

This storm followed in the foot tracks of the other one. It formed east of Tokyo on the 8th. On the 10th the LOW was near 36°N, 162°E. Two ships had northerly winds over 50 kn at 0600. In contrast to the other storm, this was a small concentrated one. The GOLDEN ACE was near the point of occlusion with 50-kn winds at 2100. Three hours later the YAMAHIDE MARU was 300 mi south of the center with 45 kn and 23-ft waves. The 8KWS was reporting again, and at 0300 the winds were 65 kn and increased to 70 kn at 0600 with 33-ft waves near 42°N, 180°. The storm was 950 mb at 0000 on the 12th. The swell waves were building up to 25 ft in the southwest quadrant. The storm was traveling northward and losing its strength. It traveled northwestward over the Bering Sea and disappeared over the cold land of Siberia.

In the middle of the month the ocean was broken into many small pressure centers. On the 0000 analysis of the 15th a frontal wave was discovered north of Hawaii. Twenty-four hours later the storm was 980 mb near 33°N, 140°W. The AMERICAN LANCER was near 29°N, 143°W, with 60-kn winds and 20-ft seas. Two other ships under the storm's influence had winds of 50 kn or more and 21-ft waves. At 1200 the MAUI was blasted by 72-kn winds, 25-ft seas, and 30-ft swells near 30°N, 136°W, about 400 mi south of the center. As the storm approached the California coast, a ship had 40-kn winds and 25-ft swells. On the 17th the storm had lost its punch but continued up the coast until the 19th.

Although this storm followed the one above and took the same general track, it formed earlier but much farther west. It was first noticed on the 0000 analysis of the 14th. It quickly gained strength, and a Japanese ship near 34°N, 174°E, south of the center had 40-kn gales. On the 15th the storm was 984 mb near 38°N, 178°W. The TOYOTA MARU No. 17 (34°N, 177°E) had 50-kn winds and 21-ft waves. The ZEEBRUGGE (35°N, 176°E) found the winds to be only 43 kn, but the waves were 36 ft. At 1800 a SHIP had 48 kn and 25-ft swells. On the 16th the higher wind reports were between 40 and 50 kn with waves up to 25 ft.

On the 17th a new LOW formed about 500 mi east of this one. The 6ZYZ (32°N, 163°W) contended with 63 kn. The INDUS MARU (28°N, 158°W) found 50-kn winds, 26-ft seas, and 33-ft swells. At 1800 three American ships, the GENEVIEVE LYKES, MANUAWILI, and MAUI were in the general area of 27°N, 145°W, with 40- to 50-kn winds and 20- to 36-ft waves. On the 18th the eastern LOW raced ahead to join another, and one from the west raced in to join this one. There were waves up to 28 ft west of the front. The GENEVIEVE LYKES (25°N,145°W) now had 55-kn winds and swell waves of 33 ft. The last severe weather associated with the storm was a report of 23-ft waves early on the 19th.

These last two LOWs plus several more struck the California coast between the 13th and 23d with heavy rains, thunderstorms, and at least one tornado (fig. 67). An article describing this series of storms starts on page 255 of this issue. Rainfall amounts ranged from a minimum of 5 in on the coast to a maximum of 30 in in the foothills and mountains. Roofs collapsed on numerous warehouses and industrial buildings. Winds up to 50 mi/h hit northern California with blackouts from downed powerlines. Flash floods and landslides damaged or destroyed many homes causing widespread evacuation. A tor-

Figure 67.--The tornado tearing the roof off the Fresno Air Terminal. Pete Stommel took this photograph with a telephoto lens from across the street. Wide World Photo.

nado raked the Fresno air terminal, causing extensive damage and leaving 3 to 5 in of hail. Flooding occurred as far inland as Idaho.

At San Clemente pounding waves snapped pilings under the municipal pier, and the 225-ft LADY ALEXANDRIA, a floating restaurant at Redondo Beach, had to be scuttled as high waves threatened to break her moorings.

On the 22d San Diego had areas with water 5 ft deep. The National Guard was called in as 1,500 people were evacuated in Palm Springs. In San Jacinto east of Los Angeles 7,000 to 8,500 people were evacuated on the 21st when a dam and levee broke. At least 36 people died. Damages were estimated at $32 million with 110 homes destroyed and 1,350 damaged during this series of storms.

Meanwhile, in Baja California flood waters cut off all roads out of Ensenada. It was estimated that there were 10,000 homeless in that area with at least 12 deaths.

This potential storm was centered over Cheju-Do island, Korea, when first analyzed on the 18th. It moved eastward over Japan and encountered the SEATRAIN YORKTOWN near 35°N, 151°E, late on the 19th with 48-kn winds. At 0000 on the 20th the LOW was 996 mb at 35°N, 156°E. At that time the EASTERN HORNET was about 100 mi south of the center with 55-kn winds and 41-ft waves. A ship farther southwest had 23 ft.

On the 21st the CHESTNUT HILL (37°N, 177°W) reported a pressure of 984 mb, the same as the central pressure on the analysis, 40-kn winds, and 36-ft swell waves. The winds and waves were mostly in the gale and less than 20-ft category, but at 1200 on the 22d the PAN PACIFIC (50°N, 148°W) reported 60-kn winds. On the 23d the storm was over Bristol Bay and curving northwestward.

This was a relatively short-lived storm. The cyclonic circulation was first found late on the 25th around a point of occlusion of a front out of another fairly strong LOW. It was supporting 45-kn winds and swell waves up to 26 ft. The VAN WARRIOR was north of this storm and found 50-kn winds and 20- to 25-ft waves at 0000 on the 26th. By 0000 on the 27th the 972-mb LOW was near 49°N, 177°E. The ZIM HAIFA (50°N, 165°E) was braving 45-kn winds and 33-ft swell waves. The EASTERN PACIFIC (49°N, 176°E) had 50-kn winds, while the SHINZUI MARU west of the storm had 30-ft swell waves. At 0600 the PRESIDENT KENNEDY (53°N, 176°W) and another ship reported 60-kn winds with 20-ft waves. On the 28th the storm disappeared into another circulation.

A wave formed on a stationary front over the East China Sea late on the 25th. The storm raced eastward south of Japan at over 60 kn on the 26th. There were a few minimal gale reports. On the 27th the TOYOTA MARU No. 10 had 52-kn winds as she passed through the cold front. By 0000 on the 28th a Japanese ship near 41°N, 174°E, had 55-kn winds. The storm was 984 mb near 43°N, 172°E. At 1200 there were wave

Continued on page 310.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

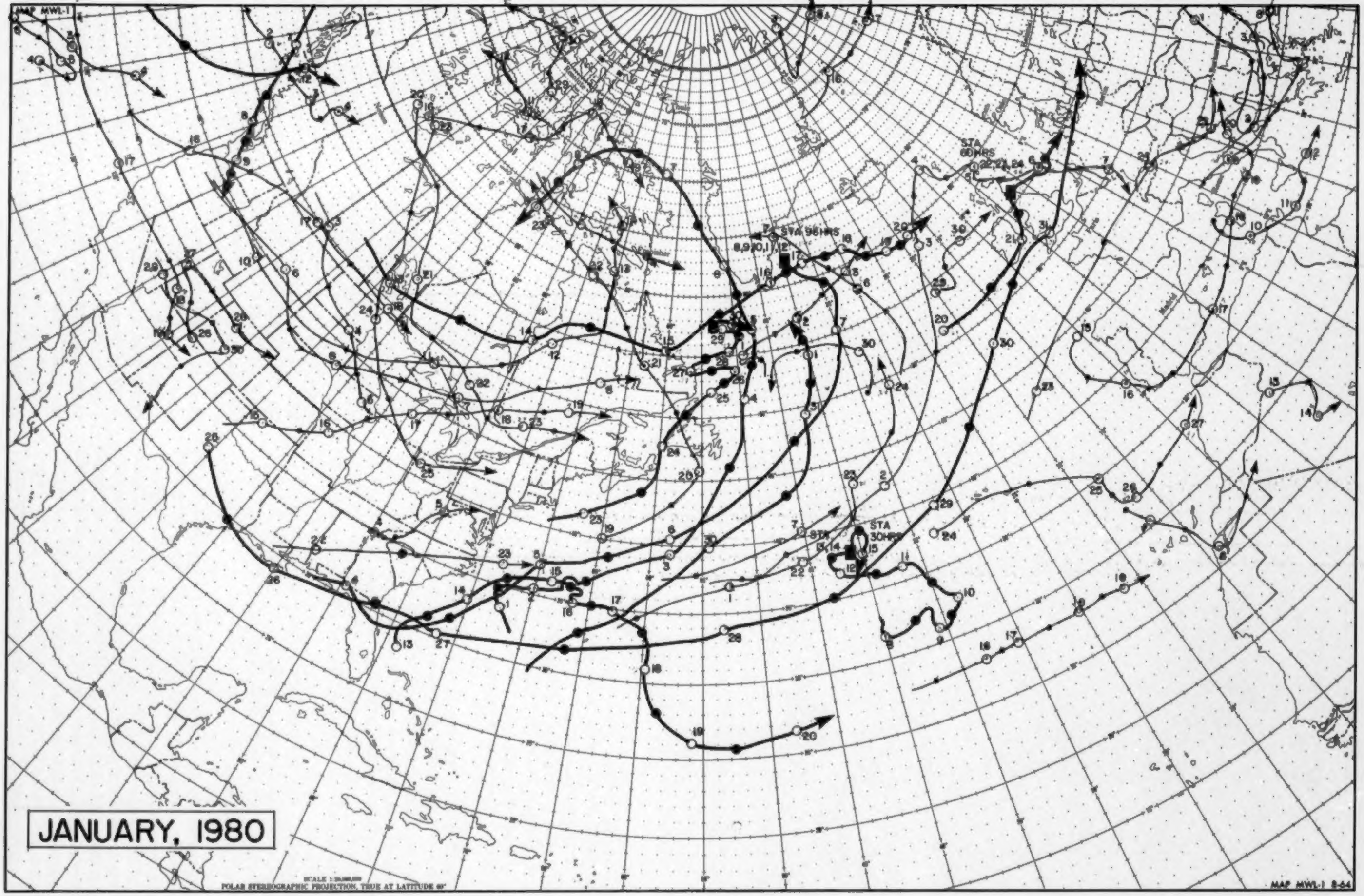


Figure 68. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

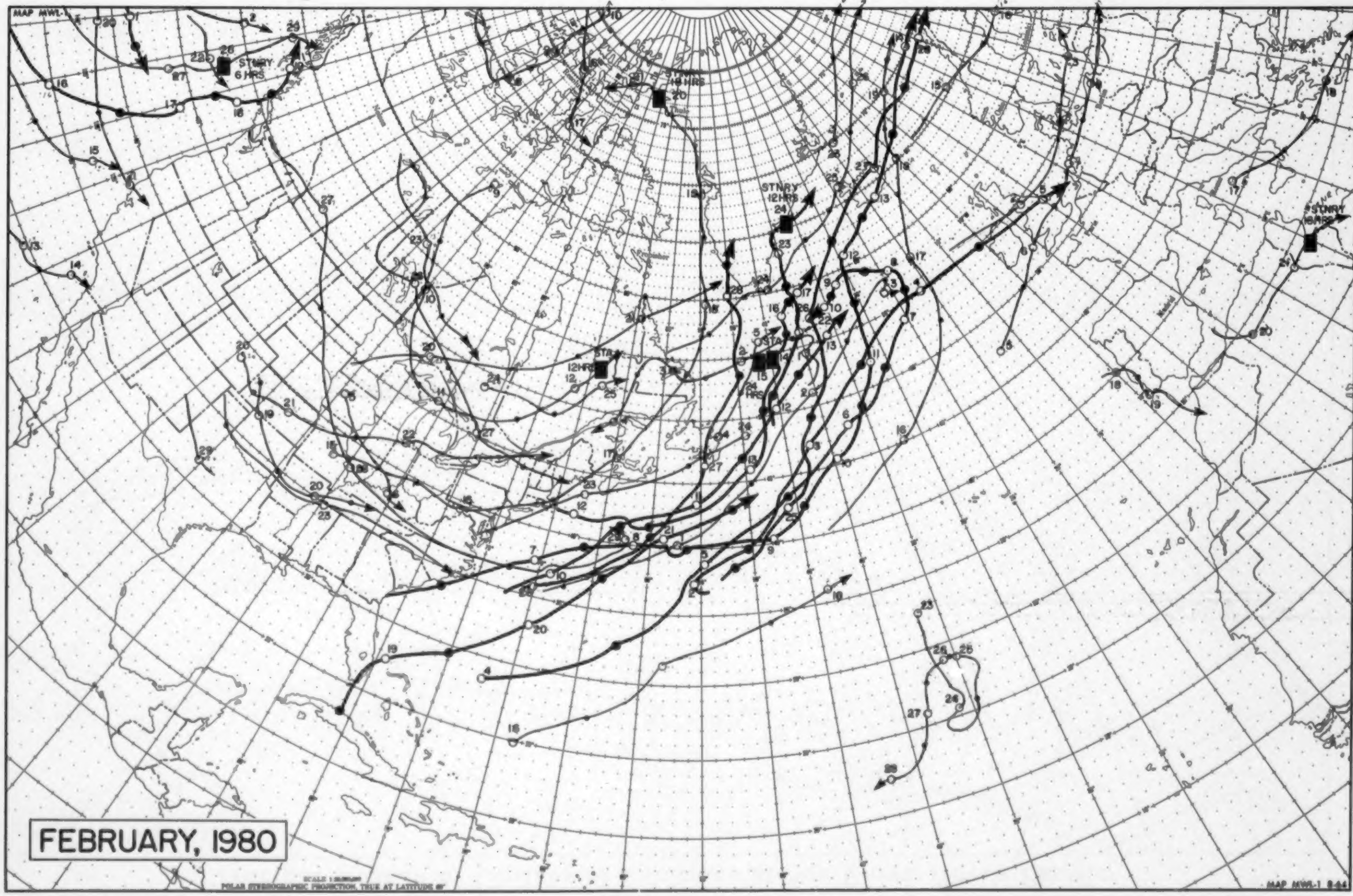


Figure 69. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

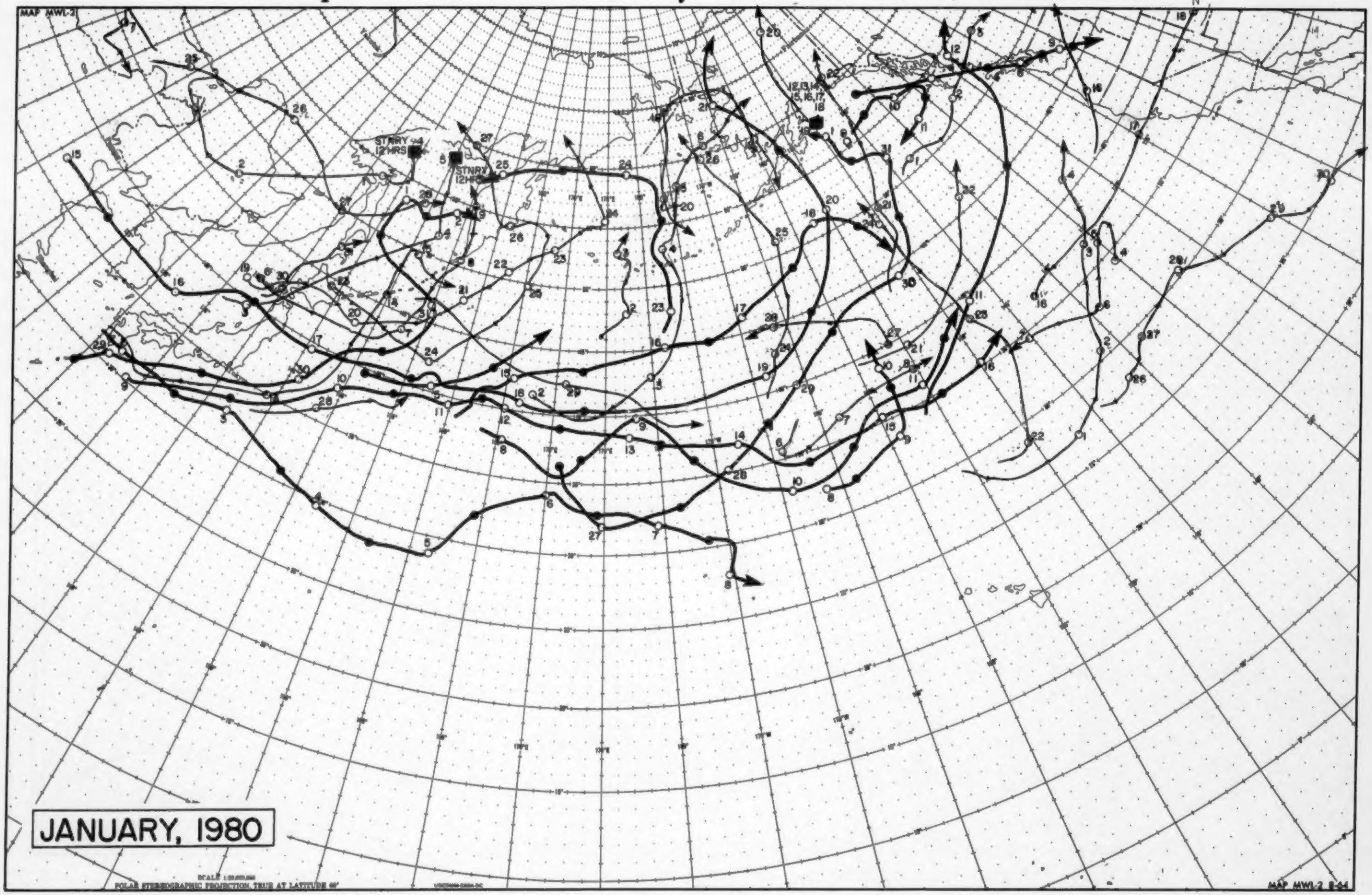


Figure 70. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

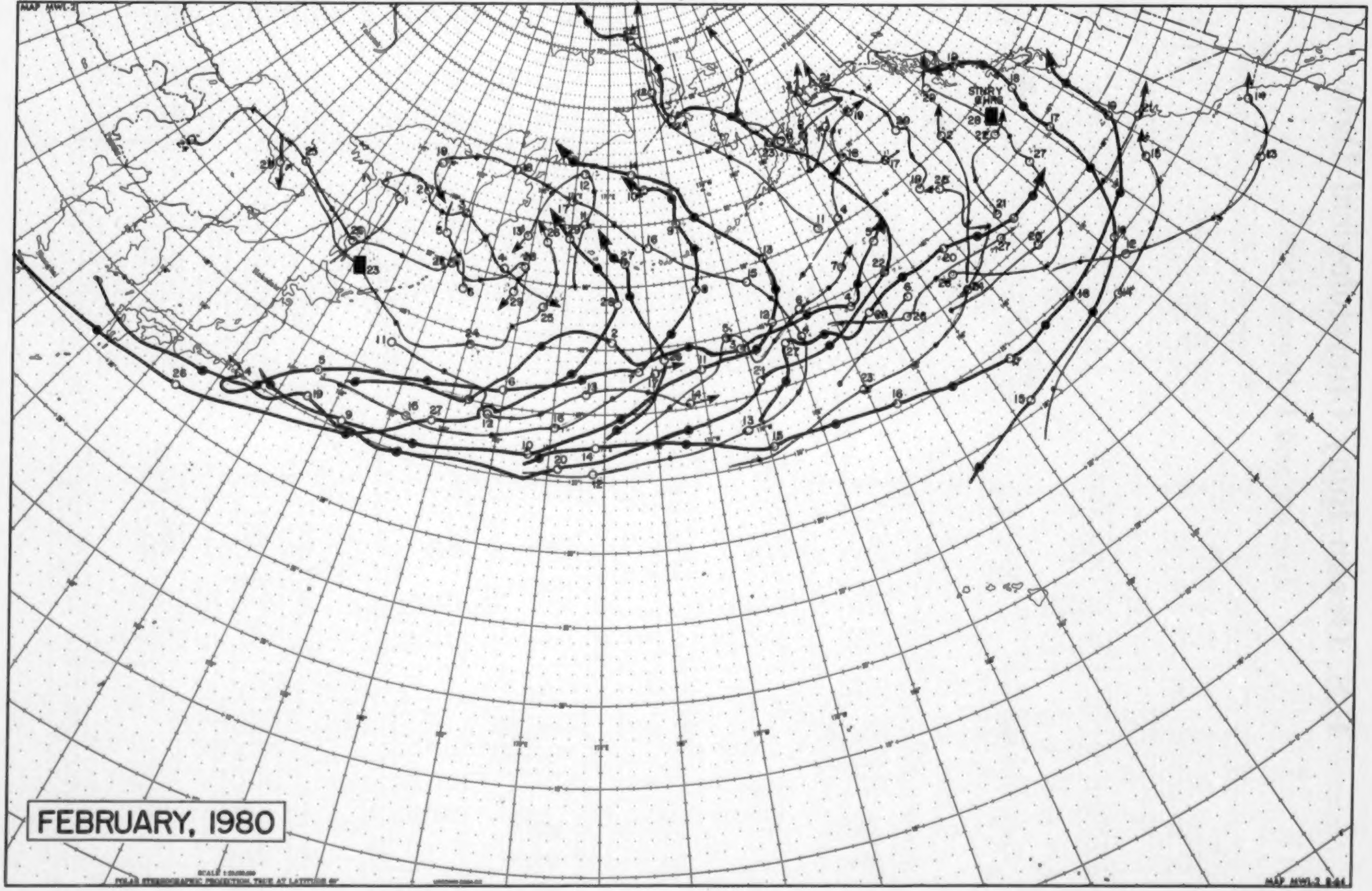


Figure 71. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

U.S. Ocean Buoy Climatological Data

January and February 1980

JANUARY — DATA SUMMARY — 41001

AVERAGE LATITUDE 34.7N — AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.2	(24 12)	14.8	20.6	(14 16)	230	31
SEA TEMP (DEG C)	16.3	(31 12)	19.3	20.4	(01 18)	234	31
AIR-SEA TEMP (DEG C)	-11.4	(24 12)	-04.5	00.9	(14 18)	230	31
PRESSURE (MBAR)	U994.2	(23 21)	1016.0	1035.3	(11 03)	234	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 232

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	3.0	7.3	9.1	.4		20.3	19.7
NE	.4	1.7	3.9	2.6			8.6	16.6
E	.4		3.9	2.2	.9		7.3	20.9
SE		.4		2.6			3.0	23.4
S		1.7	1.7	6.5	.9		10.8	23.5
SW	.4	.4	2.2	4.7	.4		8.2	22.8
W	.4	1.7	2.2	9.9	1.7		15.9	24.4
NW		4.3	9.5	6.9	5.2		25.9	22.1
CALM								
TOTAL	2.2	13.4	30.6	44.4	9.5		100.0	21.7

MAX WIND — SPEED: 42 KNOTS; DIRECTION: 260 DEG; DAY: 06; HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 225

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		21.8	28.0	20.0	24.4	5.3	.4		3.1M	6.0M (16 09)

FEBRUARY — DATA SUMMARY — 41001

AVERAGE LATITUDE 34.7N — AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.3	(02 18)	11.4	19.2	(26 00)	209	29
SEA TEMP (DEG C)	17.2	(29 21)	17.9	19.1	(24 21)	209	29
AIR-SEA TEMP (DEG C)	-14.8	(02 18)	-06.5	01.1	(29 06)	207	29
PRESSURE (MBAR)	0998.2	(26 12)	1015.4	1029.1	(14 03)	209	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 208

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		3.4	4.8	7.7			15.9	18.9
NE		1.9	.5	1.0			3.4	12.3
E	.5	1.4	2.4				4.3	13.1
SE		1.0	.5				1.4	10.0
S		.5	2.4	1.4	.5		4.8	19.6
SW	.5	1.0	5.3	3.4	.5		10.6	19.5
W		2.9	8.2	2.9	3.4		17.3	20.9
NW	.5	3.8	18.8	15.4	3.4		41.8	20.8
CALM	.5						.5	.0
TOTAL	1.9	15.9	42.8	31.7	7.7		100.0	19.5

MAX WIND — SPEED: 46 KNOTS; DIRECTION: 260 DEG; DAY: 26; HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 201

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		24.9	30.3	17.4	21.9	4.5	1.0		2.9M	8.0M (26 21)

JANUARY — DATA SUMMARY — 41003

AVERAGE LATITUDE 30.3N — AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	06.7	(06 12)	16.9	22.7	(12 00)	248	31
SEA TEMP (DEG C)	18.6	(28 03)	21.5	23.1	(01 03)	248	31
AIR-SEA TEMP (DEG C)	-15.2	(06 12)	-04.6	00.8	(12 00)	248	31
PRESSURE (MBAR)	1002.3	(23 12)	1018.3	1026.9	(10 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 248

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.6	4.0	13.3	.8			19.8	12.1
NE		2.8	4.0	1.6			8.5	15.0
E		3.6	1.6	.4			5.6	10.8
SE		1.6	4.4	.4			6.5	13.9
S		4.0	6.0	2.4			12.5	15.1
SW		1.6	7.3	3.6			12.5	17.0
W	.4	2.8	6.5	6.0			15.7	17.5
NW	.8	2.8	8.9	5.2			17.7	16.9
CALM	1.2						1.2	.0
TOTAL	4.0	23.4	52.0	20.6			100.0	14.9

MAX WIND — SPEED: 29 KNOTS; DIRECTION: 290 DEG; DAY: 23; HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	13.3	54.8	29.4	2.4					1.4M	3.0M (24 09)

FEBRUARY — DATA SUMMARY — 41003

AVERAGE LATITUDE 30.3N — AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.3	(01 18)	14.0	20.4	(24 03)	230	29
SEA TEMP (DEG C)	16.2	(28 03)	19.7	22.0	(01 00)	230	29
AIR-SEA TEMP (DEG C)	-17.2	(01 18)	-05.7	00.7	(23 00)	230	29
PRESSURE (MBAR)	1004.5	(17 00)	1018.9	1027.1	(08 15)	230	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 230

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	9.1	19.1	7.8			36.5	16.0
NE		1.3	4.8	.4			6.5	15.3
E	.4	1.3	2.6				4.3	13.3
SE			1.3				1.3	16.3
S		2.2	4.3	1.7			8.3	15.9
SW		1.3	8.7	3.9			13.9	17.4
W	.4	3.5	7.8	3.5			15.2	15.9
NW		1.3	9.1	3.0			13.5	17.2
CALM	.4						.4	.0
TOTAL	1.7	20.0	57.8	20.4			100.0	16.1

MAX WIND — SPEED: 32 KNOTS; DIRECTION: 330 DEG; DAY: 26; HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 230

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	13.5	53.9	29.1	3.5					1.5M	3.5M (26 15)

JANUARY — DATA SUMMARY — 41005

AVERAGE LATITUDE 31.7N — AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	06.4	(06 12)	15.4	21.4	(23 03)	248	31
SEA TEMP (DEG C)	18.7	(06 03)	20.3	22.2	(03 12)	248	31
AIR-SEA TEMP (DEG C)	-13.4	(24 12)	-04.9	02.1	(11 21)	248	31
PRESSURE (MBAR)	1000.6	(23 12)	1016.0	1028.7	(10 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 248

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.2	8.1	9.7	1.6			20.6	12.1
NE	.4	2.4	4.8	4.4			12.5	16.3
E		1.6	2.8	1.2			5.6	16.3
SE		2.0	1.2	1.2			4.4	13.8
S		.8	3.6	.8			5.2	15.9
SW	1.2	2.4	5.6	2.0			11.3	15.5
W	.8	1.6	7.7	8.9			19.0	19.1
NW		6.0	8.1	5.6			19.8	15.6
CALM	1.6						1.6	.0
TOTAL	5.2	25.4	43.5	25.8			100.0	15.3

MAX WIND — SPEED: 32 KNOTS; DIRECTION: 250 DEG; DAY: 31; HOUR: 15

FEBRUARY — DATA SUMMARY — 41005

AVERAGE LATITUDE 31.7N — AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.2	(01 18)	17.4	20.0	(23 06)	226	29
SEA TEMP (DEG C)	17.2	(29 12)	18.8	21.5	(03 00)	226	29
AIR-SEA TEMP (DEG C)	-19.0	(02 12)	-06.5	01.8	(10 06)	226	29
PRESSURE (MBAR)	1002.0	(17 00)	1018.7	1028.9	(08 15)	226	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 225

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		5.3	16.4	9.8			31.6	16.6
NE		3.1	8.9	1.8			13.8	14.8
E	.4	2.7		.4			3.6	9.4
SE	.4		.9				1.3	11.0
S	.4	.9	2.7				4.0	11.8
SW		.9	9.8	4.9			15.6	18.6
W		1.8	8.4	6.2			16.4	19.1
NW		3.6	6.2	2.7	.9		13.3	17.1
CALM	.4						.4	.0
TOTAL	1.8	18.2	53.3	25.8	.9		100.0	16.4

MAX WIND — SPEED: 38 KNOTS; DIRECTION: 310 DEG; DAY: 26; HOUR: 09

JANUARY — DATA SUMMARY — 42001

AVERAGE LATITUDE 25.9N — AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	16.4	(02 03)	21.9	25.6	(16 21)	162	22
SEA TEMP (DEG C)	24.2	(31 21)	25.0	26.2	(07 21)	163	22
AIR-SEA TEMP (DEG C)	-09.2	(02 03)	-03.1	00.3	(16 15)	161	22
PRESSURE (MBAR)	1007.3	(22 21)	1016.5	1023.1	(20 15)	154	21

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 147

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		4.1	6.8	3.4			14.3	15.4
NE	.7	4.1	2.7				7.5	9.5
E	1.4	4.1	26.5				32.0	13.9
SE		2.0	8.8				10.9	14.3
S		1.4	13.6	1.4			16.3	15.3
SW	.7		4.8	2.0			7.5	17.0
W		.7	2.7	.7			4.1	13.7
NW			6.1	1.4			7.5	19.2
CALM								
TOTAL	2.7	16.3	72.1	8.8			100.0	14.7

MAX WIND — SPEED: 31 KNOTS; DIRECTION: 340 DEG; DAY: 23; HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 213

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	15.0	68.5	13.1	3.3					1.3M	3.5M (24 00)

FEBRUARY — DATA SUMMARY — 42001

AVERAGE LATITUDE 25.9N — AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.7	(02 00)	18.4	24.2	(09 21)	96	12
SEA TEMP (DEG C)	23.2	(10 21)	23.9	25.4	(12 18)	96	12
AIR-SEA TEMP (DEG C)	-09.1	(01 21)	-05.5	00.4	(09 21)	96	12
PRESSURE (MBAR)	1010.4	(09 21)	1020.3	1025.9	(04 15)	96	12

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 96

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		8.3	13.5	6.3			28.1	15.3
NE		10.4	15.6	3.1			29.2	13.8
E	2.1	10.4	9.4				21.9	11.1
SE		1.0	7.3	1.0			9.4	18.1
S			5.2				5.2	20.0
SW			1.0	1.0			2.1	20.5
W								
NW		1.0	1.0	2.1			4.2	16.0
CALM								
TOTAL	2.1	31.3	53.1	13.5			100.0	14.7

MAX WIND — SPEED: 27 KNOTS; DIRECTION: 330 DEG; DAY: 10; HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 96

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	22.9	44.8	16.8	13.5					1.5M	3.5M (10 18)

JANUARY — DATA SUMMARY — 42002

AVERAGE LATITUDE 26.0N — AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.1	(24 00)	20.3	23.7	(11 21)	248	31
SEA TEMP (DEG C)	20.6	(30 03)	21.5	23.6	(19 21)	248	31
AIR-SEA TEMP (DEG C)	-07.2	(24 00)	-01.3	01.2	(11 21)	248	31
PRESSURE (MBAR)	1006.6	(26 21)	1016.4	1023.9	(05 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 248

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		3.2	6.0	2.0			11.3	14.7
NE	1.2	4.4	6.9	.4			12.9	11.2
E	2.4	6.0	6.9				15.3	9.8
SE	.8	12.1	12.9				25.8	10.1
S	1.6	8.9	12.1				22.6	11.0
SW		2.0	1.6				3.6	10.7
W		.4					.4	4.0
NW	.8	2.0	1.6	2.4			6.9	15.5
CALM	1.2						1.2	.0
TOTAL	8.1	39.1	48.0	4.8			100.0	11.2

MAX WIND — SPEED: 32 KNOTS — DIRECTION: 330 DEG — DAY: 23 — HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	21.0	69.4	6.5	2.0	1.2				1.2M	4.0M (23 18)

JANUARY — DATA SUMMARY — 42003

AVERAGE LATITUDE 26.0N — AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	16.1	(24 12)	21.0	24.6	(31 18)	154	20
SEA TEMP (DEG C)	21.7	(30 15)	22.2	25.7	(31 21)	154	20
AIR-SEA TEMP (DEG C)	-06.0	(25 00)	-01.2	01.5	(23 09)	154	20
PRESSURE (MBAR)	1007.9	(23 09)	1017.5	1024.4	(20 15)	154	20

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 154

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.6	5.2	4.5	.6			11.0	10.6
NE		5.2	10.4				15.6	12.0
E		6.5	18.8				25.3	12.6
SE	1.9	3.2	20.1				25.3	13.4
S	.6	5.8	3.2				9.7	9.4
SW	.6	.6	3.2				4.5	10.9
W	1.9		1.9				3.9	9.7
NW			1.9	2.6			4.5	20.3
CALM								
TOTAL	5.8	26.6	64.3	3.2			100.0	12.4

MAX WIND — SPEED: 27 KNOTS — DIRECTION: 310 DEG — DAY: 23 — HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 154

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	7.1	83.1	5.8	3.2	.6				1.3M	4.0M (24 08)

JANUARY — DATA SUMMARY — 42005

AVERAGE LATITUDE 30.0N — AVERAGE LONGITUDE 085.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.1	(05 09)	14.2	20.3	(23 03)	248	31
SEA TEMP (DEG C)	15.4	(24 15)	16.8	19.2	(23 03)	248	31
AIR-SEA TEMP (DEG C)	-12.0	(05 09)	-02.6	02.6	(18 15)	249	31
PRESSURE (MBAR)	1002.8	(23 06)	1018.5	1026.4	(06 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 248

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	3.6	10.1	1.6			16.1	13.5
NE	.8	2.8	5.2				8.9	11.2
E	1.6	9.3	10.5	.8			22.2	11.4
SE	.4	3.2	6.9	2.4			12.9	13.9
S	.8	3.2	6.5				10.5	11.8
SW	1.6	2.8	2.4				6.9	9.8
W	.8	3.2	1.2				5.2	6.1
NW	.8	2.8	10.9	2.8			17.3	16.0
CALM								
TOTAL	7.7	31.0	53.6	7.7			100.0	12.6

MAX WIND — SPEED: 25 KNOTS — DIRECTION: 350 DEG — DAY: 31 — HOUR: 15

JANUARY — DATA SUMMARY — 42006

AVERAGE LATITUDE 26.5N — AVERAGE LONGITUDE 096.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.9	(31 21)	19.8	23.1	(21 18)	248	31
SEA TEMP (DEG C)	20.1	(18 06)	21.8	23.2	(22 15)	248	31
AIR-SEA TEMP (DEG C)	-10.4	(23 21)	-01.9	01.3	(30 15)	248	31
PRESSURE (MBAR)	1005.7	(26 12)	1015.9	1026.1	(23 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 248

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	6.0	6.9	2.8			16.1	12.7
NE	.8	3.6	4.8				9.3	9.7
E	.4	2.8	6.9				10.1	11.7
SE	1.6	10.5	13.7				25.8	10.8
S	2.0	5.2	16.9				24.2	12.6
SW	.8	1.2	.4				2.4	6.0
W	.4	2.8	.4				3.6	7.3
NW	.4	2.0	2.0	2.4			6.9	15.2
CALM	1.6						1.6	.0
TOTAL	8.5	34.3	52.0	5.2			100.0	11.4

MAX WIND — SPEED: 26 KNOTS — DIRECTION: 010 DEG — DAY: 31 — HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 223

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	8.1	70.9	17.0	2.7	1.3				1.5M	4.0M (31 15)

FEBRUARY — DATA SUMMARY — 42002

AVERAGE LATITUDE 26.0N — AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	12.1	(17 18)	18.7	23.5	(24 21)	238	29
SEA TEMP (DEG C)	20.2	(18 12)	21.2	22.8	(22 21)	238	29
AIR-SEA TEMP (DEG C)	-08.9	(01 21)	-02.5	01.5	(21 18)	238	29
PRESSURE (MBAR)	1008.7	(21 09)	1018.4	1029.3	(26 18)	238	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 238

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.7	2.6	6.1	6.1			16.5	16.8
NE		3.9	7.4	4.3			15.7	16.0
E	.9	12.6	7.8	1.3			21.7	10.4
SE	.9	9.6	10.4	2.6			23.5	12.6
S	.9	6.5	9.6				17.0	10.7
SW	.9	.9					1.7	3.8
W	1.7	.9					2.6	3.5
NW	.4			.4			.9	14.5
CALM	.4						.4	.0
TOTAL	7.8	37.0	40.4	14.8			100.0	12.6

MAX WIND — SPEED: 29 KNOTS — DIRECTION: 360 DEG — DAY: 17 — HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 230

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	23.0	45.7	20.0	10.4	.9				1.5M	4.0M (18 09)

FEBRUARY — DATA SUMMARY — 42003

AVERAGE LATITUDE 26.0N — AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	12.5	(02 03)	19.1	25.3	(24 21)	230	29
SEA TEMP (DEG C)	21.3	(19 15)	24.6	26.1	(28 21)	230	29
AIR-SEA TEMP (DEG C)	-13.1	(02 03)	-05.4	02.1	(23 15)	230	29
PRESSURE (MBAR)	1009.0	(16 21)	1019.5	1027.5	(27 15)	230	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 230

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	5.2	13.9	7.0			26.5	15.9
NE		9.6	9.1				18.7	16.7
E	2.6	7.0	11.7	1.7			23.0	11.0
SE	.4	5.2	2.6				8.3	9.9
S	1.7	5.7	6.1				13.5	9.9
SW	.9		1.7				2.6	10.7
W		.9	1.3	.4			2.6	13.4
NW		.9	3.0	.9			4.8	16.4
CALM								
TOTAL	6.1	34.3	49.6	10.0			100.0	12.4

MAX WIND — SPEED: 27 KNOTS — DIRECTION: 360 DEG — DAY: 26 — HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 230

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	24.3	53.5	21.7	.4					1.2M	3.0M (01 18)

FEBRUARY — DATA SUMMARY — 42005

AVERAGE LATITUDE 30.0N — AVERAGE LONGITUDE 085.9W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-01.0	(01 12)	11.1	19.4	(24 06)	230	29
SEA TEMP (DEG C)	13.6	(18 09)	15.2	17.3	(25 21)	230	29
AIR-SEA TEMP (DEG C)	-17.2	(01 12)	-04.2	03.9	(24 06)	230	29
PRESSURE (MBAR)	1005.9	(16 21)	1020.3	1030.7	(26 15)	230	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 230

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.9	6.5	15.2	7.0			29.6	15.6
NE	.4	3.0	4.8	.4			8.7	12.6
E	.4	3.9	7.8				12.2	13.3
SE	1.7	6.5	2.6	.9			11.7	10.2
S	.4	6.5	4.3	1.3			12.6	11.7
SW		2.2	2.2	.4			4.8	13.0
W	.9	3.0	7.8				11.7	11.7
NW	.9	2.6	1.7	3.0			8.3	15.2
CALM	.4						.4	.0
TOTAL	6.1	34.3	46.5	13.0			100.0	13.3

MAX WIND — SPEED: 30 KNOTS — DIRECTION: 330 DEG — DAY: 26 — HOUR: 06

FEBRUARY — DATA SUMMARY — 42006

AVERAGE LATITUDE 26.5N — AVERAGE LONGITUDE 096.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.6	(17 15)	17.3	21.9	(24 18)	179	23
SEA TEMP (DEG C)	19.3	(11 03)	20.3	20.9	(29 21)	179	23
AIR-SEA TEMP (DEG C)	-10.9	(17 15)	-03.0	01.4	(08 21)	179	23
PRESSURE (MBAR)	1009.4	(29 21)	1020.0	1030.8	(26 18)	179	23

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 179

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.2	2.8	13.4	6.1			24.6	15.6
NE	1.1	6.1	10.1				17.3	11.4
E	.6	8.9	5.6	.6			15.6	10.6
SE	2.2	7.8	9.5	1.7			21.2	11.7
S	.6	4.5	6.7				11.7	11.6
SW	.6	1.7					2.2	6.0
W								
NW	1.1		2.2	2.2			5.6	17.5
CALM	1.7						1.7	.0
TOTAL	10.1	31.8	47.5	10.6			100.0	12.9

MAX WIND — SPEED: 26 KNOTS — DIRECTION: 340 DEG — DAY: 16 — HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 211

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	10.0	46.4	26.5	15.2	1.9				1.7M	4.0M (17 00)

JANUARY — DATA SUMMARY — 44002

AVERAGE LATITUDE 40.1N — AVERAGE LONGITUDE 073.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-05.7	(31 12)	02.9	12.9	(12 03)	245	31
SEA TEMP (DEG C)	06.3	(31 09)	08.1	09.5	(03 15)	245	31
AIR-SEA TEMP (DEG C)	-12.1	(31 12)	-05.2	04.5	(12 03)	245	31
PRESSURE (MBAR)	0992.2	(23 21)	1016.9	1037.8	(11 00)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 247

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		6.1	12.6	4.9			23.5	15.4
NE		4.5	8.5	3.2			16.2	16.0
E	.4	2.0	4.0	.8			7.3	12.9
SE		.4	1.6				2.0	11.4
S		1.2	2.8	1.2			5.3	17.2
SW			1.6	2.0			3.6	22.9
W		2.4	3.6	3.6			9.7	17.9
NW		6.1	19.4	6.9			32.4	16.9
CALM								
TOTAL	.4	22.7	54.3	22.7			100.0	16.3

MAX WIND
SPEED: 33 KNOTS
DIRECTION: 240 DEG
DAY: 07
HOUR: 21

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 7.8% SEVERE: NONE #OBS: 245

JANUARY — DATA SUMMARY — 44003

AVERAGE LATITUDE 40.8N — AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-05.3	(30 18)	03.0	13.3	(12 09)	248	31
SEA TEMP (DEG C)	05.3	(31 21)	07.2	09.0	(01 18)	248	31
AIR-SEA TEMP (DEG C)	-11.5	(30 18)	-04.2	05.6	(12 09)	248	31
PRESSURE (MBAR)	0988.0	(24 06)	1014.1	1039.4	(11 03)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 123

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	2.4	4.1	12.2	2.4		22.0	22.7
NE	.8	4.1	3.3	2.4	4.1		14.6	20.2
E	2.4	4.9	7.3	1.6			16.3	12.6
SE		1.6	.8				2.4	8.7
S		1.6	4.9	3.3	.8		10.6	18.4
SW				.8			.8	24.0
W		2.4	6.5	4.9			13.8	18.4
NW		4.1	13.8	1.6			19.5	15.4
CALM								
TOTAL	4.1	21.1	40.7	26.8	7.3		100.0	17.9

MAX WIND
SPEED: 37 KNOTS
DIRECTION: 030 DEG
DAY: 15
HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 234

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	1.3	18.8	28.2	20.9	19.2	11.5			3.2M	7.5M (16 18)

JANUARY — DATA SUMMARY — 44004

AVERAGE LATITUDE 39.0N — AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-01.9	(24 15)	07.2	17.8	(12 09)	246	31
SEA TEMP (DEG C)	12.3	(30 18)	14.7	16.2	(04 09)	247	31
AIR-SEA TEMP (DEG C)	-16.2	(24 15)	-07.5	02.8	(12 09)	246	31
PRESSURE (MBAR)	0991.0	(23 18)	1016.2	1040.2	(11 03)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 245

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		2.0	6.9	5.7	6.1	.4	21.2	26.4
NE	.8	2.4	3.3	2.0	.8		9.4	17.2
E	.4	1.2	1.6	2.0	.4		5.7	18.2
SE	.4	1.2	1.2	.8			3.7	14.3
S		1.2	.4	3.3	.8		5.7	23.0
SW			.4	2.0			2.4	25.2
W		.4	7.3	8.6	2.4		18.9	24.1
NW		.8	14.3	17.6	.4		33.1	20.8
CALM								
TOTAL	1.6	9.4	35.5	42.0	11.0	.4	100.0	22.1

MAX WIND
SPEED: 49 KNOTS
DIRECTION: 020 DEG
DAY: 05
HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	2.9	21.3	22.1	24.6	17.2	9.4	2.5		3.2M	9.5M (16 09)

JANUARY — DATA SUMMARY — 44005

AVERAGE LATITUDE 42.7N — AVERAGE LONGITUDE 068.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-07.7	(30 15)	01.1	11.0	(12 06)	247	31
SEA TEMP (DEG C)	06.0	(31 18)	07.4	08.2	(02 21)	247	31
AIR-SEA TEMP (DEG C)	-14.3	(30 15)	-06.3	03.1	(12 09)	247	31
PRESSURE (MBAR)	0985.8	(24 06)	1014.1	1038.3	(11 03)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 247

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		2.4	9.3	4.9	2.4		19.0	20.0
NE		1.6	1.6	4.9	1.6		9.7	23.8
E	.4	1.6	2.0	.8	.8		5.7	17.6
SE	.4		1.2	.4			2.0	16.2
S	.4	2.4	2.0	4.9	.4		10.1	19.5
SW		.4	1.6	1.2			3.2	20.3
W		1.6	8.5	13.8	3.2		27.1	24.3
NW		.4	11.7	10.1	.4		22.7	22.4
CALM	.4						.4	.0
TOTAL	1.6	10.5	38.1	40.9	8.9		100.0	21.7

MAX WIND
SPEED: 41 KNOTS
DIRECTION: 280 DEG
DAY: 24
HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 163

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	5.5	23.3	27.0	22.7	17.2	4.3			2.7M	6.5M (25 00)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE:19.4% SEVERE: NONE #OBS: 247

FEBRUARY — DATA SUMMARY — 44002

AVERAGE LATITUDE 40.1N — AVERAGE LONGITUDE 073.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-08.2	(01 12)	00.3	07.8	(16 15)	229	29
SEA TEMP (DEG C)	04.2	(22 03)	05.8	07.2	(02 15)	229	29
AIR-SEA TEMP (DEG C)	-14.8	(01 12)	-05.5	03.0	(16 15)	229	29
PRESSURE (MBAR)	0993.5	(16 21)	1015.6	1026.7	(13 15)	229	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 229

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.7	5.2	16.2	8.3			31.4	16.4
NE		4.8	1.7	1.7			8.3	12.5
E		1.7	3.5	.9			6.1	14.3
SE		.4					.4	10.0
S		.4	.4				.9	12.0
SW	.4	2.6	4.4	.4			7.9	11.9
W	.4	5.7	8.3	.4			14.8	12.7
NW		4.4	19.7	5.2			29.3	16.9
CALM	.9						.9	.0
TOTAL	3.5	25.3	54.1	17.0			100.0	15.0

MAX WIND
SPEED: 30 KNOTS
DIRECTION: 030 DEG
DAY: 07
HOUR: 09

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE:24.0% SEVERE: NONE #OBS: 229

FEBRUARY — DATA SUMMARY — 44003

AVERAGE LATITUDE 40.8N — AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-07.7	(29 18)	00.5	07.2	(23 09)	217	29
SEA TEMP (DEG C)	03.2	(29 12)	04.0	05.8	(01 06)	217	29
AIR-SEA TEMP (DEG C)	-11.1	(29 18)	-03.5	03.7	(23 09)	217	29
PRESSURE (MBAR)	0991.8	(17 00)	1012.4	1026.2	(19 15)	217	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 73

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		5.5	2.7	6.8			15.1	17.0
NE		2.7	6.8				9.6	13.6
E		4.1	8.2				12.3	12.5
SE		2.7					2.7	8.5
S	1.4						1.4	3.0
SW		5.5					5.5	7.8
W	1.4	9.6	19.2	5.5			35.6	13.3
NW	1.4	6.8	6.8	2.7			17.8	12.9
CALM								
TOTAL	4.1	37.0	43.8	15.1			100.0	13.1

MAX WIND
SPEED: 29 KNOTS
DIRECTION: 010 DEG
DAY: 26
HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 212

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	.5	28.3	45.8	15.1	6.1	1.9	2.4		2.5M	9.0M (08 03)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE:11.0% SEVERE: NONE #OBS: 73

FEBRUARY — DATA SUMMARY — 44004

AVERAGE LATITUDE 39.0N — AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-03.5	(29 18)	04.7	14.6	(23 06)	230	29
SEA TEMP (DEG C)	08.5	(24 21)	12.7	16.5	(22 06)	230	29
AIR-SEA TEMP (DEG C)	-16.1	(29 18)	-08.0	03.8	(23 06)	230	29
PRESSURE (MBAR)	0991.8	(07 15)	1015.0	1029.2	(19 12)	230	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 230

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.3	2.2	4.3	1.7	.9	10.4	26.4
NE		.9	3.0	.9	.9		5.7	20.8
E		1.3	2.2	.4		.4	4.3	18.2
SE			.4	.4			.9	17.5
S		1.7	.4	.9			3.0	14.0
SW		1.3	4.3	.9			6.5	14.9
W	.4	3.5	18.7	10.0	.9		33.5	19.1
NW		2.6	21.3	9.6	1.7		35.2	19.8
CALM	.4						.4	.0
TOTAL	.9	12.6	52.6	27.4	5.2	1.3	100.0	19.7

MAX WIND
SPEED: 51 KNOTS
DIRECTION: 350 DEG
DAY: 07
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 229

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	1.3	36.2	27.1	21.4	8.3	2.6	2.2	.9	2.6M	10.0M (08 06)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 1.7% SEVERE: NONE #OBS: 230

FEBRUARY — DATA SUMMARY — 44005

AVERAGE LATITUDE 42.7N — AVERAGE LONGITUDE 068.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-08.6	(29 18)	-00.8	07.1	(23 09)	230	29
SEA TEMP (DEG C)	04.7	(07 06)	05.5	06.6	(04 00)	230	29
AIR-SEA TEMP (DEG C)	-13.6	(29 18)	-06.3	01.8	(23 09)	230	29
PRESSURE (MBAR)	0988.5	(17 03)	1012.3	1025.1	(07 03)	230	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 230

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.9	3.5	9.6	6.5	1.3		21.7	18.6
NE	.4	.4	3.9	.4			5.2	14.8
E		3.5	1.3	1.7			6.5	14.9
SE		.9	1.7	1.7			4.3	17.8
S			1.7	.4			2.2	17.2
SW		.4	4.8	2.2			7.4	18.2
W		2.2	12.6	4.3			19.1	17.2
NW	.4	4.3	21.3	7.0			33.0	16.8
CALM	.4						.4	.0
TOTAL	2.2	15.2	57.0	24.3	1.3		100.0	17.1

MAX WIND
SPEED: 37 KNOTS
DIRECTION: 020 DEG
DAY: 08
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 146

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	3.4	48.6	34.9	8.9	2.7	1.4			1.9M	6.5M (08 09)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE:31.7% SEVERE: NONE #OBS: 230

JANUARY — DATA SUMMARY — 46001

AVERAGE LATITUDE 56.0N — AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-08.1	(14 21)	01.5	05.9	(20 21)	245	31
SEA TEMP (DEG C)	04.2	(30 15)	04.6	05.0	(06 18)	244	31
AIR-SEA TEMP (DEG C)	-12.3	(14 21)	-03.0	01.2	(20 21)	244	31
PRESSURE (MBAR)	0962.6	(12 18)	1007.6	1038.2	(27 09)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 245

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.8	4.9	1.2	.4		7.3	19.1
NE	.4	.4	2.9	1.6	.4		5.7	17.8
E	.4	.8	6.9	4.5	.8		13.5	19.9
SE	.4	.4	4.5	3.3	3.3		11.8	24.8
S	.8	1.2	2.9	6.9	.4		12.2	22.0
SW	.4	1.2	5.7	6.1			13.5	20.0
W		2.4	9.0	9.8	.4		21.6	20.5
NW	.8	1.6	6.9	4.9			14.3	17.2
CALM								
TOTAL	3.3	9.0	43.7	38.4	5.7		100.0	20.3

MAX WIND — SPEED: 44 KNOTS — DIRECTION: 140 DEG — DAY: 18 — HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 245

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		11.4	29.8	27.8	20.0	9.0	2.0		3.4M	9.0M (19 06)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE:16.3% SEVERE: NONE #OBS: 245

FEBRUARY — DATA SUMMARY — 46001

AVERAGE LATITUDE 56.0N — AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-01.9	(03 21)	03.0	06.6	(11 03)	230	29
SEA TEMP (DEG C)	03.8	(29 18)	04.3	04.8	(13 00)	230	29
AIR-SEA TEMP (DEG C)	-06.3	(03 21)	-01.3	01.1	(11 03)	230	29
PRESSURE (MBAR)	0966.8	(03 00)	0997.9	1021.0	(13 12)	230	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 230

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.9		.9	.4			2.2	11.8
NE		3.0	7.4	2.2			12.6	14.4
E	.9	5.7	11.3	1.3	.4		19.6	13.9
SE	.4	.4	8.3	11.3	3.9		24.3	25.0
S	.4	2.6	8.7	5.2			17.0	17.9
SW	.4	2.2	5.2	2.6			10.4	15.8
W		3.5	7.4	1.7			12.6	14.0
NW		.4	.9				1.3	11.8
CALM								
TOTAL	3.0	17.8	50.0	24.8	4.3		100.0	17.5

MAX WIND — SPEED: 38 KNOTS — DIRECTION: 150 DEG — DAY: 04 — HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 226

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		21.7	28.8	16.4	29.2	4.0			3.0M	6.5M (05 00)

JANUARY — DATA SUMMARY — 46002

AVERAGE LATITUDE 42.5N — AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.2	(18 00)	09.6	14.9	(12 03)	245	31
SEA TEMP (DEG C)	12.0	(29 12)	12.8	13.5	(05 00)	246	31
AIR-SEA TEMP (DEG C)	-07.7	(18 00)	-03.2	01.9	(12 03)	245	31
PRESSURE (MBAR)	0978.2	(12 03)	1016.4	1032.0	(23 18)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 245

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		6.1	15.1	.8			22.0	12.7
NE		1.6	13.5	4.9			20.0	16.3
E	.8	4.9	2.9	3.3			11.8	12.9
SE		1.2	2.9	1.6			5.7	16.1
S	2.0	.4	3.3	5.3			11.0	18.5
SW	.8	3.3	2.0	2.4	.8		9.4	16.3
W		1.6	9.3	.4			11.0	14.1
NW		2.4	4.5	1.2	.4		8.6	15.7
CALM	.4						.4	.0
TOTAL	4.1	21.6	53.1	20.0	1.2		100.0	15.4

MAX WIND — SPEED: 39 KNOTS — DIRECTION: 210 DEG — DAY: 12 — HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		17.2	40.2	21.3	17.6	3.7			2.8M	7.0M (12 12)

FEBRUARY — DATA SUMMARY — 46002

AVERAGE LATITUDE 42.5N — AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.2	(22 06)	11.1	14.3	(26 06)	229	29
SEA TEMP (DEG C)	11.7	(27 06)	12.3	12.9	(23 21)	229	29
AIR-SEA TEMP (DEG C)	-04.3	(22 06)	-01.3	02.3	(26 06)	229	29
PRESSURE (MBAR)	0976.7	(18 00)	1008.8	1033.2	(07 09)	229	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 229

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		4.4	3.1				7.4	10.2
NE	.4	1.3	2.2				3.9	9.3
E		3.1	6.6	.4			10.0	12.9
SE	.4	5.7	8.3	3.5			17.9	14.1
S	.4	2.2	12.7	9.6	.4		25.3	19.4
SW	.4	3.9	11.4	1.3			17.0	14.8
W	.4	1.3	6.1	2.6			10.5	15.9
NW		4.4	3.5				7.9	10.3
CALM								
TOTAL	2.2	26.2	53.7	17.5	.4		100.0	14.7

MAX WIND — SPEED: 34 KNOTS — DIRECTION: 200 DEG — DAY: 27 — HOUR: 22

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 229

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		3.5	32.8	33.6	28.4	1.3	.4		3.3M	8.0M (27 21)

JANUARY — DATA SUMMARY — 46004

AVERAGE LATITUDE 51.0N — AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-01.7	(12 15)	04.5	07.5	(22 18)	248	31
SEA TEMP (DEG C)	05.1	(29 18)	05.8	06.6	(22 03)	248	31
AIR-SEA TEMP (DEG C)	-07.6	(12 15)	-01.3	01.9	(21 09)	248	31
PRESSURE (MBAR)	0963.3	(12 03)	1014.1	1040.2	(24 21)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 248

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.2	10.5	5.2	2.4		19.4	21.1
NE	.8	.4	8.5	.8			10.5	15.2
E			1.6				1.6	16.3
SE		.8	2.4	2.4	2.0		7.7	24.8
S		.4	11.3	5.2	1.2		18.1	20.9
SW		.4	4.4	7.7			12.5	22.0
W	.4	2.4	2.8	11.7	1.2		18.5	22.8
NW		.8	6.0	4.0	.8		11.7	21.2
CALM								
TOTAL	1.2	6.5	47.6	37.1	7.7		100.0	21.1

MAX WIND — SPEED: 42 KNOTS — DIRECTION: 150 DEG — DAY: 30 — HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		15.7	32.3	27.8	24.2				2.9M	5.5M (31 06)

FEBRUARY — DATA SUMMARY — 46004

AVERAGE LATITUDE 51.0N — AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	02.3	(16 00)	05.7	08.1	(07 06)	238	29
SEA TEMP (DEG C)	05.3	(15 09)	05.6	06.6	(14 03)	238	29
AIR-SEA TEMP (DEG C)	-03.4	(16 00)	00.1	02.7	(07 06)	238	29
PRESSURE (MBAR)	0971.8	(02 15)	1005.6	1025.9	(18 09)	238	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 238

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	1.7	6.1	.4			8.7	14.5
NE		2.2	9.6	.9			12.6	16.4
E		3.0	3.9	1.7			8.7	15.8
SE	.4	2.2	11.3	9.1	1.7		24.8	21.8
S		.9	17.0	7.4			25.2	19.1
SW		.4	3.9	1.7	.4		6.5	20.4
W	.9	.4	2.6	1.3	.4		5.7	18.0
NW		.9	2.6	3.5			7.0	20.0
CALM	.9						.9	.0
TOTAL	2.6	11.7	57.0	20.1	2.6		100.0	18.7

MAX WIND — SPEED: 44 KNOTS — DIRECTION: 250 DEG — DAY: 02 — HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 287

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		6.3	46.9	24.2	22.7				2.9M	5.1M (24 00)

JANUARY — DATA SUMMARY — 46005

AVERAGE LATITUDE 46.0N — AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.8	(10 03)	07.5	11.0	(02 03)	246	31
SEA TEMP (DEG C)	08.5	(27 12)	09.4	10.3	(01 00)	246	31
AIR-SEA TEMP (DEG C)	-07.6	(10 03)	-01.9	01.2	(31 18)	246	31
PRESSURE (MBAR)	0963.8	(12 03)	1015.3	1032.6	(23 18)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 246

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		4.1	13.0	4.1			21.1	17.1
NE		1.2	7.7	2.8			11.8	18.6
E		.4	.8				1.2	10.1
SE		.4	5.3	6.1			11.8	21.4
S	.4	4.9	10.6	2.0			17.9	14.6
SW		.8	6.5	4.9			12.2	18.9
W		1.6	6.1	5.3			13.0	20.0
NW		1.6	6.5	2.4	.4		11.0	18.7
CALM								
TOTAL	.4	15.0	56.5	27.6	.4		100.0	18.0

MAX WIND — SPEED: 36 KNOTS — DIRECTION: 330 DEG — DAY: 18 — HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		13.0	40.7	35.8	10.6				2.7M	5.5M (10 09)

FEBRUARY — DATA SUMMARY — 46005

AVERAGE LATITUDE 46.0N — AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.0	(16 06)	08.6	11.5	(26 09)	230	29
SEA TEMP (DEG C)	08.5	(20 18)	08.9	09.2	(09 06)	230	29
AIR-SEA TEMP (DEG C)	-04.7	(16 06)	-00.3	02.6	(26 09)	230	29
PRESSURE (MBAR)	0975.5	(18 09)	1006.5	1030.4	(07 18)	230	29

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 230

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	3.0	5.2	.4				8.7	5.5
NE	.9	2.2	6.1				9.1	12.3
E		3.9	5.7	1.7			11.3	14.3
SE	.4	4.3	11.7	8.7	.4		25.7	17.2
S		4.8	11.7	4.3	.4		21.3	16.9
SW		1.3	5.7	6.1			13.0	20.1
W	.4	1.3	1.3	.9	.4		4.3	17.7
NW		2.2	2.2	1.7			6.1	14.8
CALM	.4						.4	.0
TOTAL	5.2	25.2	44.8	23.5	1.3		100.0	15.5

MAX WIND — SPEED: 42 KNOTS — DIRECTION: 270 DEG — DAY: 06 — HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 230

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		7.0	36.5	37.0	18.7	.9			3.0M	7.5M (20 00)

JANUARY DATA SUMMARY 46010
AVERAGE LATITUDE 46.2N AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-05.1	(28 15)	05.9	12.5	(12 12)	238	31
SEA TEMP (DEG C)	04.3	(29 12)	08.6	11.4	(07 09)	237	31
AIR-SEA TEMP (DEG C)	-12.2	(28 15)	-02.7	02.6	(12 12)	237	31
PRESSURE (MBAR)	0974.3	(12 06)	1015.6	1030.6	(23 06)	238	31

WIND - % FREQUENCIES, MEANS AND EXTREMES NO. OF OBS: 238

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.5	3.3	3.3				9.2	6.7
NE	.4	7.1	4.2				11.7	8.8
E		8.3	28.8				37.1	13.2
SE	.4	2.5					2.9	6.9
S	.4	.8	6.3	2.9			10.4	18.1
SW		.8	4.6	1.3	.4		7.1	18.5
W	.4	4.2	6.3	1.3			12.1	11.8
NW		4.2	3.3	.8			8.3	12.8
CALM	1.3						1.3	.0
TOTAL	5.4	31.3	56.7	6.3	.4		100.0	12.6

MAX WIND
SPEED: 35 KNOTS
DIRECTION: 210 DEG
DAY: 12
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 218

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	6.0	27.1	35.3	22.0	8.3	1.4			2.3M	7.0M	(12 09)

% OF OBS WITH POTENTIAL SUPERSTRUCTURE ICING MODERATE: 3.8% SEVERE: NONE #OBS: 238

FEBRUARY DATA SUMMARY 46010
AVERAGE LATITUDE 46.2N AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	00.7	(14 21)	08.4	14.0	(27 21)	216	28
SEA TEMP (DEG C)	06.7	(13 09)	09.4	10.7	(04 00)	216	28
AIR-SEA TEMP (DEG C)	-08.0	(14 21)	-01.1	04.0	(27 21)	216	28
PRESSURE (MBAR)	0978.6	(16 12)	1011.3	1033.6	(07 18)	216	28

WIND - % FREQUENCIES, MEANS AND EXTREMES NO. OF OBS: 216

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.5	2.8	.9				4.2	8.7
NE	.5	2.8					3.2	6.7
E	1.4	5.6	40.7	.9			48.6	14.6
SE		3.2	1.9				5.1	10.1
S	.5	1.9	13.4	6.0			21.8	17.3
SW	.5	.5	7.9	.5			9.3	15.2
W	.5	1.4	.9				2.8	8.5
NW	.5	1.4	1.4				3.2	8.3
CALM	1.9						1.9	.0
TOTAL	6.0	19.4	67.1	7.4			100.0	13.8

MAX WIND
SPEED: 30 KNOTS
DIRECTION: 190 DEG
DAY: 02
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 215

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		21.9	36.3	23.3	18.1	.5			2.7M	6.0M	(01 03)

JANUARY DATA SUMMARY 41002
AVERAGE LATITUDE 32.3N AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	10.6	(06 12)	17.9	21.6	(12 06)	110	14
SEA TEMP (DEG C)	21.2	(13 15)	21.7	22.4	(02 03)	110	14
AIR-SEA TEMP (DEG C)	-11.5	(06 12)	-03.8	-00.2	(12 06)	110	14
PRESSURE (MBAR)	1003.9	(05 12)	1018.7	1031.6	(10 15)	110	14

WIND - % FREQUENCIES, MEANS AND EXTREMES NO. OF OBS: 110

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			4.5	3.6			8.2	19.5
NE		1.8	1.8	2.7			6.4	18.3
E		.9	.9	7.3			9.1	23.5
SE		.9	.9	5.5			7.3	21.0
S	1.8	3.6	3.6	5.5			14.5	16.0
SW			9.1	2.7	.9		12.7	20.0
W	.9	3.6	10.0	9.1			23.6	19.8
NW		4.5	7.3	5.5	.9		18.2	19.1
CALM								
TOTAL	2.7	15.5	38.2	41.8	1.8		100.0	19.3

MAX WIND
SPEED: 37 KNOTS
DIRECTION: 220 DEG
DAY: 05
HOUR: 08

JANUARY DATA SUMMARY 41004
AVERAGE LATITUDE 32.6N AVERAGE LONGITUDE 078.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.1	(06 12)	14.9	22.7	(11 21)	248	31
SEA TEMP (DEG C)	18.1	(03 18)	20.5	22.3	(18 12)	248	31
AIR-SEA TEMP (DEG C)	-14.4	(06 12)	-05.6	01.9	(11 21)	248	31
PRESSURE (MBAR)	0999.4	(23 18)	1017.9	1031.5	(10 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES NO. OF OBS: 248

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	6.9	12.5	1.6			21.4	13.8
NE	.4	4.4	8.1	4.0			16.9	15.1
E	1.6	2.4	1.6	2.0			7.7	12.7
SE		.8	1.6	1.2			3.6	18.1
S	.8	1.2	1.6	1.6			4.8	16.0
SW		.4	4.4	2.4			7.3	18.8
W		2.4	11.3	7.7			21.4	18.3
NW	.4	5.2	6.5	3.6			15.7	14.9
CALM	1.2						1.2	.0
TOTAL	4.4	23.0	47.6	24.2			100.0	15.5

MAX WIND
SPEED: 30 KNOTS
DIRECTION: 300 DEG
DAY: 24
HOUR: 03

JANUARY DATA SUMMARY 46003
AVERAGE LATITUDE 52.0N AVERAGE LONGITUDE 156.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-04.3	(13 18)	02.2	06.2	(04 21)	103	13
SEA TEMP (DEG C)	03.7	(13 15)	04.0	04.2	(07 06)	103	13
AIR-SEA TEMP (DEG C)	-08.1	(13 18)	-01.8	02.1	(04 21)	103	13
PRESSURE (MBAR)	0981.6	(13 18)	1014.3	1033.5	([illegible] 09)	103	13

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 145

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		11.0	25.5	17.9	33.1	12.4			3.6M	7.5M	(15 03)

Continued from page 301.

reports of 20 to 25 ft south of the center. On the 29th the storm was traveling northwestward to dissipate.

Another occlusion-conceived storm. This was first discovered late on the 26th north of Midway Island. The BOLNES was in the southwest quadrant with 46-kn winds and 16-ft seas. At 0000 on the 28th the storm was 972 mb near 43°N, 162°W. The MORI MARU near 41°N, 162°W, had 52-kn winds and 30-ft waves. The TACAMAR was quite a distance south (31°N, 164°W) with 44-kn winds and 26-ft waves. Later in the day there were several gale reports, and at 1800 the YOZAN MARU (43°N, 160°W) had 50-kn winds from the northwest and 26-ft swells. On the 29th the SEALAND FINANCE had 40-kn winds, and a ship near 39°N, 144°W, had 33-ft swells. Several ships had waves over 20 ft. The facsimile sea-wave analysis indicated a fairly large area south of the center with sea waves over 20 ft. The PORT VANCOUVER was being pounded by 34-ft swell waves at 1200. As the storm approached the U.S. West Coast on March 2, it broke into multiple centers.

Casualties--The 975-ton NISSEN MARU was presumed sunk on the 2d off Shiriya Saki after reporting a bad list in heavy weather. The crew of nine were not found. The American PRESIDENT JEFFERSON (21,467 tons) sustained heavy-weather damage enroute to Yokohama the first week of the month. The American crabber PACIFIC TRADER (192 tons) sank on the 7th near 55°N, 165°W. Three of the five crewmen were lost. The 5,774-ton CYNTHIA G. out of Yokohama was adrift with a heavy list due to engine trouble and collapse of cargo stowage in heavy weather.

The 7,673-ton Greek N.G. LIVANOS from Vancouver to Yokohama reported heavy-weather damage on arrival on the 12th. The Greek motorvessel ATHANASSIA was due Yokohama on the 15th with weather damage. The 103,812-ton American tanker STUYVESANT encountered heavy weather on a voyage in ballast from Los Angeles to Valdez. The PRESIDENT MADISON (21,467 tons) was at Yokohama on the 20th with heavy-weather damage. The Chinese ferry TWILIGHT 401 out of Canton capsized during a tornado on the 27th. Over 200 people were still missing on March 1.

The following vessels also suffered heavy weather damage: GRAND ZODIAC, OCEAN CONTAINER, and SARFARAZ RAFIQI. The Japanese fishing vessel EISHO MARU No. 51 sank off Hokkaido on the 26th in rough weather. Of 22 crewmembers, 2 died and 4 were missing.

Other Casualties--The two British ships DUNELMIA (9,346 tons) and IRON BARON (5,583 tons) arrived Australia this month with weather damage.

Selected Gale and Wave Observations, North Atlantic

January and February 1980

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C. Air	Temperature °C. Sea	Sea Waves Period sec.	Sea Waves Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
NORTH ATLANTIC OCEAN		JAN.															
BALTIMORE TRADER	KASJ	2	35.2 N	74.7 W	06	34	50	2 NM	15	1001.5	7.2	22.2	4	16.5	34	< 6	19.5
AMERICAN RANGER	KNKW	2	34.4 N	66.5 W	18	24	50	5 NM	25	0997.0	18.4	18.9	10	18	24	>13	19.5
AMERICAN RANGER	KNKW	3	34.3 N	67.8 W	00	27	65	1 NM	65	0997.6	17.3	18.9	8	6.5	24	>13	23
TFL DEMOCRACY	9VPR	3	42.6 N	51.6 W	12	10	M 47	1 NM	65	0993.0	10.0	4.0					
AMERICAN ACCORD	KFEZ	4	41.8 N	45.3 W	06	26	50	2 NM	02	0997.0	12.2	16.7	5	16.5			
AMERICAN ACE	KFCV	4	47.8 N	40.1 W	12	18	45	5 NM	25	0983.2	13.4	13.4	4	10			
TFL DEMOCRACY	9VPR	4	44.1 N	43.3 W	12	25	M 47	5 NM	02	0998.5	8.5	15.0					
AMERICAN LEGACY	KFGJ	4	49.0 N	42.4 W	18	24	50	.5 NM	56	0996.5	2.8	9.4	6	8	23	12	16.5
AMERICAN LEGACY	KFGJ	5	48.0 N	46.2 W	12	27	45	2 NM	20	0999.4	- 1.1	3.3	7	11.5	27	>13	19.5
C V STAGHOUND	KAFQ	5	39.1 N	70.3 W	12	05	45	2 NM	07	0996.2	10.6	12.2	7	14.5	05	7	14.5
GEORGE WALTON	KFEU	5	43.2 N	43.2 W	18	30	47	5 NM	81	1013.0	7.8	16.7	7	11.5	30	9	39
SEATRAIN GALVESTON	S6HM	5	41.6 N	43.0 W	18	29	50	5 NM	02	1015.0	10.0	17.0	7	16	28	< 6	8
GEORGE WALTON	KFEU	6	43.1 N	44.7 W	00	30	42	10 NM	02	1019.0	7.2	16.7	7	11.5	30	9	24.5
MANHATTAN DUKE	S6FC	6	40.5 N	64.0 W	12	36	M 60	2 NM	44	1010.0	6.8	15.0	16	29.5	36	>13	31
AMERICAN LEGEND	KFEY	9	48.5 N	07.4 W	18	31	45	5 NM	27	1014.6	10.6	10.6	5	19.5	XX		19.5
AMERICAN LEGEND	KFEY	10	47.9 N	09.1 W	00	30	47	5 NM	01	1024.7	8.9	11.7	8	23			
CHELSEA	KNCX	11	35.2 N	43.6 W	18	35	43	2 NM	25	1020.7	10.6	16.7	5	8	35	< 6	8
DOCTOR LYKES	KHMB	12	38.3 N	31.4 W	00	13	M 42	5 NM	25	1011.0	17.2	16.7					
HARDANGER	LFFG	12	36.4 N	40.4 W	18	35	50	1 NM	07	1006.0	11.8	15.0			35	9	8
OLEANDER	PJVG	12	35.6 N	67.8 W	18	20	48	5 NM	03	1018.8	19.4	22.5	6	10	20	7	13
USNS COMET	NJZP	12	36.6 N	41.0 W	18	35	55	2 NM	07	0999.0	12.2	16.7	5	13	36	8	19.5
LASH PACIFICO	WIEE	12	37.0 N	65.5 W	18	20	45	2 NM	02	1016.2	19.4	20.0	8	16.5	20	12	23
EL PASO ARZEW	KHKB	12	36.4 N	38.5 W	21	30	M 80	1 NM	07	0994.8	12.2	17.8		5	30	11	10
EL PASO ARZEW	KHKB	13	36.4 N	39.3 W	03	26	M 78	5 NM	07	0991.3	12.8	17.8					
USNS COMET	NJZP	13	36.6 N	43.1 W	06	33	55	2 NM	07	0997.5	13.3	16.7	6	14.5	33	8	23
THOMAS MAERSK	OXOX	13	36.9 N	44.3 W	12	32	45	1 NM	80	1005.2	15.1		12	16.5			
HARDANGER	LFFG	13	35.0 N	44.4 W	12	30	47	1 NM	80	1012.0	14.9	15.0			30		6.5
JUTHLANDIA	ELXV	13	40.3 N	36.6 W	18	15	42	10 NM	01	1013.0	17.0	11.7	6	6.5	15	< 6	8
JUTHLANDIA	ELXV	14	39.3 N	39.4 W	06	12	45	5 NM	07	1004.0	16.0	12.8					
JUTHLANDIA	ELXV	15	37.8 N	44.1 W	00	34	47	5 NM	02	1014.0	15.0	16.8					
ARGONAUT	KFDV	15	36.4 N	44.8 W	06	33	40	5 NM	18	1014.6	14.4	18.9	7	16.5	35	12	41
MORMACGLEN	WMDL	15	39.5 N	71.9 W	06	36	45	5 NM	02	1014.2	7.7	11.7	3	10	36	6	29.5
SEALAND PACER	KSLB	15	47.9 N	12.8 W	18	06	M 45	5 NM	02	1011.2	13.0	11.0	6	16.5	06	8	24.5
ZIM TOKYO	DDRF	15	41.4 N	44.1 W	18	02	44	2 NM	62	1018.5	15.0	15.6	4	6.5	02	7	13
CHEROKEE WMEC 165	NNGP	16	37.0 N	73.8 W	00	35	M 45	2 NM	01	1016.5	14.0	16.7	6	19.5			
ADRIAN MAERSK	OYIT	16	35.8 N	74.4 W	00	36	49	> 25 NM	02	1017.0	13.0		7	19.5			
AMERICAN LEGEND	KFEY	16	40.4 N	62.3 W	00	14	60	1 NM	63	1009.1	17.3	15.6		36			
CHELSEA	KNCX	16	46.0 N	17.6 W	06	07	41	> 25 NM	03	1024.2	8.9	12.1	6	3	07	6	10
EL PASO ARZEW	KHKB	16	36.3 N	68.0 W	15	35	M 55	2 NM	07	1000.0	17.8	18.9	4	5	34	12	23
DEFIANCE	KRBS	16	40.2 N	67.6 W	18	36	60	2 NM	54	1011.0	7.5	18.5	8	46	36	8	46
OLEANDER	PJVG	16	37.9 N	70.6 W	18	35	47	2 NM	50	1014.5	11.2	17.5	6	10	35	8	32.5
MORMACGLEN	WMDL	16	39.7 N	71.2 W	18	02	45	5 NM	02	1019.0	4.7	15.7	3	10	02	8	28
OLEANDER	PJVG	17	38.6 N	71.5 W	00	35	45	5 NM	02	1021.2	8.5	15.2	12	26			
USNS COMET	NJZP	17	31.2 N	66.9 W	00	29	50	5 NM	18	1004.0	18.8	20.6	4	13	28	< 6	16.5
EL PASO ARZEW	KHKB	17	36.0 N	71.0 W	00	35	M 45	1 NM	07	1016.0	12.8	19.4	5	6.5	36	12	24.5
AMERICAN LEGEND	KFEY	17	39.4 N	67.7 W	00	02	50	1 NM	63	1009.8	11.1	18.9		24.5			
DEFIANCE	KRBS	17	40.2 N	65.5 W	06	36	58	5 NM	58	1010.0	6.1	13.5	8	34.5	36	8	34.5
MORMACGLEN	WMDL	17	39.7 N	69.9 W	06	02	45	5 NM	02	1018.5	5.5	15.0	3	10	02	8	24.5
TFL DEMOCRACY	9VPR	17	47.5 N	29.4 W	15	27	M 42	5 NM	19	1016.0	12.0	12.0					
TFL DEMOCRACY	9VPR	20	44.5 N	60.1 W	18	30	M 48	5 NM	07	0992.0	2.3	3.5					
ARTHUR MIDDLETON	KFCJ	20	48.2 N	16.3 W	18	26	50	5 NM	07	0991.2	12.8	11.0	5	14.5	26	7	19.5
PACIFIC HIGHWAY	JLJL	20	38.8 N	48.5 W	18	16	M 41	5 NM	03	0995.0	20.0	18.0	6	23	17	9	23
ARTHUR MIDDLETON	KFCJ	21	48.8 N	19.0 W	00	26	50	5 NM	07	0998.0	12.6	11.7	5	16.5	26	7	23
TFL DEMOCRACY	9VPR	21	43.2 N	64.6 W	07	27	M 47	10 NM	03	1002.5	- 2.5	3.3					
EXPORT BUILDER	KEXB	21	34.7 N	65.3 W	12	30	42	10 NM	15	1010.0	14.4	21.1	3	6.5	31	8	18
MEONIA	OXON	22	32.3 N	51.1 W	06	27	M 45	10 NM	81	1006.7	18.4		6	13			
WESTERN SUN	KEHJ	22	26.1 N	90.7 W	18	18	18	10 NM	02	1010.5	26.7	61.0	50	65.5			
SNOWLAND	SGFA	24	37.2 N	42.4 W	00	31	46	10 NM	01	1009.8	12.4				31	>13	19.5
EL PASO ARZEW	KHKB	24	36.1 N	36.7 W	00	29	42	5 NM	60	1003.7	13.4	17.3	6	8	29	10	14.5
AUSTRAL PILOT	KNKZ	24	35.3 N	67.4 W	12	28	45	5 NM	15	0997.8	19.5	19.4	6	19.5			
TONCI TOPIC	ELKX	24	34.5 N	36.5 W	12	29	44	10 NM	02	1006.0	16.0	19.8	5	11.5			
MARJORIE LYKES	KAXP	24	35.0 N	30.9 W	18	31	M 50	5 NM	25	0994.5	16.7	16.7	3	6.5	31	7	19.5
ARTHUR MIDDLETON	KFCJ	24	46.6 N	52.6 W	18	22	45	1 NM	23	0970.5	1.1	0.0	5	10	XX		10
ADM WM M CALLAGHAN	KGYE	24	45.4 N	56.0 W	18	25	45	10 NM	45	0972.5	2.8	- 0.6	5	10	25	< 6	13
AMERICAN CHAMPION	WMEY	24	38.1 N	49.3 W	18	23	45	5 NM	25	0998.0	18.9	16.7	6	13	20	9	19.5
ADM WM M CALLAGHAN	KGYE	25	42.5 N	62.7 W	00	27	50	5 NM	26	0991.0	1.0	5.0	5	13	27	8	19.5
EL PASO ARZEW	KHKB	25	35.8 N	23.1 W	06	31	45	2 NM	03	1003.9	16.7	16.7	7	5	31	9	10
ARECIBO	KYVN	25	35.7 N	72.0 W	06	27	41	10 NM	02	1003.1	17.2	21.2					
AMERICAN CHAMPION	WMEY	25	37.3 N	50.0 W	12	27	45	5 NM	07	1000.0	20.0	18.4	6	10	27	8	19.5
ARTHUR MIDDLETON	KFCJ	25	46.2 N	57.3 W	12	25	60	2 NM	02	0969.0	- 4.2	0.0	5	16.5	27	8	24.5
EXXON BANGOR	KEAH	25	26.8 N	89.5 W	18	23	15	10 NM	91	1011.9	23.0	45.0	2	3			
TENNESSEE	LFEI	25	42.8 N	63.3 W	18	27	M 50	.5 NM	85	0990.5	0.0	3.8	10	23			
TENNESSEE	LFEI	26	42.5 N	60.9 W	00	27	M 50	5 NM	85	0994.0	2.3		10	23			
MORMACSUN	WMBK	26	40.5 N	63.2 W	12	27	45	5 NM	01	0997.1	5.0	12.3			27	8	24.5
PIONEER CONTENDER	WNFC	26	42.0 N	62.9 W	18	28	45	10 NM	02	0997.5	1.7	11.1	10	14.5			
EXPORT FREEDOM	WCJS	26	37.6 N	58.8 W	18	28	42	10 NM	02	0998.3	15.6	19.4	4	5	26	< 6	19.5
TENNESSEE	LFEI	27	41.3 N	51.7 W	00	29	M 45	10 NM	25	0995.0	6.0						
COVADONGA	EHQV	27	37.2 N	62.9 W	00	29	42	10 NM	03	1011.0	13.0		6	26			
SEALAND PACER	KSLB	27	43.4 N	40.0 W	06	21	M 50	5 NM	13	0972.6	14.4	11.5	6	13	21	8	34.5
AMERICAN CHAMPION	WMEY	27	36.6 N	57.7 W	06	27	45	5 NM	16	1008.0	14.5	18.3	6	19.5	27	8	23
SEALAND ECONOMY	WNDJ	27	46.6 N	52.5 W	18	25	45	10 NM	26	0984.8	- 1.1	0.6	5	8	25	12	19.5
DON CARLOS	SFBA	27	41.3 N	57.5 W	18	26	45	10 NM	03	1005.0	9.2		6	13	XX		19.5
AMERICAN ALLIANCE	KFEM	28	49.7 N	38.3 W	00	27	25	10 NM	23	0984.0	5.5	17.0	6	10			
DYVI KATTEGAT	LMPR	28	46.9 N	48.8 W	12	27	M 45	.25 NM	88	0991.0	- 1.0						
SEALAND ECONOMY	WNDJ	28	42.8 N	63.7 W	23	27	45	10 NM	02	0999.0	8.6	5.6	5	16.5	27	< 6	16.5
LAKE SHASTA	SMQL	30	43.0 N	38.6 W	06	27	50	10 NM	81	1005.3	9.8		6	19.5	27	7	26
TFL DEMOCRACY	9VPR	31	44.8 N	36.8 W	05	14	M 43	2 NM	07	0997.3	15.2	13.8					
LAKE SHASTA	SMQL	31	43.2 N	43.6 W	12	26	55	5 NM	02	0998.6	10.8		5	23	22	7	29.5
AMERICAN ACE	KFCV	31	49.1 N	34.8 W	18	23	45	2 NM	02	0984.0	10.0		5	14.5			
GREAT LAKES VESSELS																	
A H FERBERT	9801	7	43.4 N	87.3 W	12	25	M 42	5 NM	28		- 9.0	2.0	6	8			
EDWIN H GOTT	9901	7	45.8 N	85.8 W	12	24	M 45	5 NM	02		- 5.0	4.0	5	6.5			
ENDERS M VOORHEES	9814	11	45.6 N	86.4 W	18	24	M 41	10 NM	03		- 3.0	4.0		11.5			

Vessel	Nationality	Date	Position of Ship: Lat. deg.	Position of Ship: Long. deg.	Time GMT	Wind: Dir. 10°	Wind: Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C: Air	Temperature °C: Sea	Sea Waves+: Period sec.	Sea Waves+: Height ft.	Swell Waves: Dir. 10°	Swell Waves: Period sec.	Swell Waves: Height ft.
NORTH ATLANTIC OCEAN		JAN.															
GREAT LAKES VESSELS																	
EDWIN H GOTT	9901	12	46.7 N	84.9 W	12	31	M 45	2 NM	70		-10.0	4.0	5	6.5			
IRVING S OLDS	9819	13	47.0 N	87.3 W	06	19	M 56	5 NM	97		-10.0	4.0		10			
ENVIRONMENTAL BUOYS																	
41001		2	34.7 N	72.3 W	15	30	M 41			1001.9	14.1	19.9	8	19.5			
41001		6	34.7 N	72.3 W	03	26	M 42			1002.9	10.9	19.5	9	21			
44004		5	39.0 N	70.0 W	13	05	M 54			995.8	10.0	16.1	7	14.5			
44004		16	39.0 N	70.0 W	07	02	M 47			1009.8	9.5	14.8	11	29.5			
44005		24	42.7 N	68.3 W	21	28	M 41			989.4	- 4.5	7.1					
		FEB.															
AMERICAN ACE	KFCV	1	49.5 N	32.2 W	00	22	50	10 NM	02	0990.8	7.7	13.4	6	19.5			
MORMACALTAIR	WMSM	1	34.6 N	62.7 W	06	25	65	.5 NM	63	1009.7	16.6	21.1	3	5	25	>13	14.5
ARECIBO	KYVN	1	34.3 N	71.6 W	18	31	45	5 NM	80	1007.1	14.5	21.1	6	16.5	31	7	16.5
ADM WM M CALLAGHAN	KGYE	1	50.0 N	41.1 W	18	26	57	5 NM	02	0994.3	3.8	6.2	5	11.5	26	8	24.5
YOUNG AMERICA	WGLW	2	46.2 N	38.2 W	00	20	45	2 NM	62	0995.0	13.3	12.3	5	6.5	21	7	11.5
ARECIBO	KYVN	2	37.4 N	72.8 W	12	31	50	5 NM	83	1015.2	- 1.2	15.7	6	18			
AMERICAN RACER	KNDF	2	34.0 N	49.5 W	18	20	47	2 NM	82	1003.5	20.0	18.9	5	10	20	6	11.5
C V STAGHOUND	KAFQ	3	38.9 N	53.9 W	00	33	50	2 NM	62	0993.0	8.9	17.8	4	10	01	6	11.5
FALSTRIA	OYBG	3	39.9 N	40.5 W	06	20	M 52	5 NM	02	1002.0	19.4		13	26			
ADM WM M CALLAGHAN	KGYE	3	55.9 N	16.0 W	18	09	45	5 NM	25	0996.2	7.2	8.3	3	10	26	8	16.5
ARTHUR MIDDLETON	KFCJ	4	42.9 N	63.0 W	00	24	45	10 NM	03	1009.0	- 1.5	2.2	4	6.5	25	8	6.5
T F L LIBERTY	9VDD	4	45.6 N	29.8 W	00	26	M 55	2 NM	01	1006.0	15.0	13.0					
AUSTRAL ENDURANCE	KIPF	4	51.0 N	20.0 W	12	24	47	2 NM	53	0983.4	10.0	10.0	5	13	25	8	24.5
C V LIGHTNING	K.FP	4	37.8 N	39.3 W	12	18	12	10 NM	02	1019.0	16.2	17.3	5	1.5	27	9	32.5
AMERICAN ACCORD	KFEZ	4	49.6 N	12.5 W	18	24	50	2 NM	02	0999.0	10.0	11.1	5	10			
AMERICAN LEGACY	KFGJ	4	49.7 N	15.8 W	18	26	55	5 NM	02	0995.0	10.6	12.8			26	>13	46
AMERICAN LEGACY	KFGJ	5	49.7 N	16.2 W	00	27	41	2 NM	18	1000.2	12.2	12.8					
AMERICAN ACCORD	KFEZ	5	49.8 N	05.6 W	06	24	45	2 NM	02	1001.0	10.0	8.9	4	8			
DYVI KATTEGAT	LMPR	5	42.0 N	54.0 W	12	09	M 55	.5 NM	65	1002.0	5.0						
EXPORT CHALLENGER	WLSG	5	38.7 N	43.1 W	18	19	52	2 NM	62	1001.0	18.7	18.0	4	14.5	19	7	16.5
C V LIGHTNING	KAFP	5	39.2 N	50.9 W	19	25	45	10 NM	15	0986.2	16.2	19.4	5	8	21	8	16.5
EXPORT CHALLENGER	WLSG	6	38.2 N	43.1 W	00	20	50	1 NM	64	0998.1	16.7	16.1	7	23	19	8	29.5
DYVI KATTEGAT	LMPR	6	41.9 N	50.1 W	00	05	M 60	1 NM	65	0993.0	2.0						
SEALAND RESOURCE	WJMD	6	42.2 N	40.3 W	06	19	50	5 NM	02	0982.0	13.9	13.2	7	6.5	18	8	11.5
GARTHNEWYDD	GUJR	6	39.2 N	37.1 W	18	27	45	> 25 NM	03	1000.2	17.0	18.0	XX	10	XX		29.5
AMERICAN LEGACY	KFGJ	7	46.5 N	32.5 W	00	26	63	2 NM	50	0970.0	7.8	12.2					
C V LIGHTNING	KAFP	7	39.9 N	67.5 W	12	08	45	1 NM	62	1000.5	8.8	16.7	7	11.5	08	8	13
SEALAND CONSUMER	WCHF	7	35.7 N	68.9 W	12	23	56	2 NM	02	0997.8	13.9	17.8	4	26	23	>13	29.5
COLORADO	KWFE	7	40.8 N	69.1 W	12	05	50	1 NM	22	1000.5	3.0	6.1	7	23			
NANTUCKET II	NNBN	7	40.5 N	69.2 W	18	03	M 56	200 YD	75	0999.0	2.0	5.0	6	8	06	6	19.5
MOBIL AERO	WLPY	7	36.2 N	73.5 W	18	30	43	2 NM	02	1012.2	6.1	21.6	6	28	30	10	29.5
EL PASO ARZEW	KHKB	7	32.9 N	68.7 W	18	27	48	2 NM	64	1009.2	16.6	18.3	10	13	31	9	14.5
AMERICAN ACE	KFCV	7	48.6 N	15.8 W	18	28	30	5 NM	02	0994.9	12.8	15.6	9	11.5	22	>13	39
COLORADO	KWKE	7	41.1 N	68.9 W	19	04	55	200 YD	84	0999.9	1.7	5.6	XX	41	04	>13	41
EXPORT FREEDOM	WCJS	7	41.0 N	62.1 W	21	09	45	1 NM	02	1001.0	2.8	12.2	9	16.5	08	7	10
NANTUCKET II	NNBN	8	40.5 N	69.2 W	00	04	M 50	200 YD	75	1002.5	2.0	5.0	6	19.5	04	6	19.5
SEALAND CONSUMER	WCHF	8	35.2 N	69.5 W	00	29	60	5 NM	02	1006.5	11.1	17.8	4	29.5	29	>13	32.5
LAKE SHASTA	SHQL	8	37.5 N	71.6 W	00	31	50	2 NM	81	1014.6	5.0		5	13	35	>13	23
EXPORT FREEDOM	WCJS	8	41.0 N	61.3 W	03	09	50	10 NM	01	0990.5	10.0	13.3	5	19.5	08	7	13
AMERICAN RANGER	KNKW	8	40.5 N	66.8 W	12	30	60	2 NM	68	1009.0	1.7	3.8	5	19.5	30	>13	13
GARTHNEWYDD	GUJR	8	36.3 N	47.4 W	18	19	50	2 NM	65	0992.0	16.0	18.0	XX	8	18	< 6	18
AMERICAN LEGACY	KFGJ	9	44.3 N	53.3 W	12	02	47	200 YD	70	0994.2	2.2	3.3	2	6.5	02	< 6	16.5
GARTHNEWYDD	GUJR	9	38.0 N	49.5 W	18	31	55	.5 NM	82	0984.0	13.0	20.0	XX	16.5	30	< 6	41
AMERICAN ACE	KFCV	10	43.3 N	32.1 W	00	18	50	2 NM	63	0988.8	13.9	14.4	7	23			
JACKSONVILLE	KWAH	10	24.3 N	88.3 W	06	18	08	10 NM	80	1013.1	23.7	30.0	3	32.5			
AMERICAN ACE	KFCV	11	43.3 N	38.3 W	00	29	45	10 NM	25	0993.8	10.6	14.4	6	19.5			
AMERICAN ARGOSY	KFCX	11	45.5 N	47.0 W	17	12	42	1 NM	65	0978.0	6.1	4.5	3	13			
AMERICAN ACE	KFCV	12	42.9 N	44.6 W	18	27	65	2 NM	20	0997.3	5.0	15.6	18	41			
AMERICAN ARGOSY	KFCX	12	46.5 N	36.2 W	18	23	42	5 NM	15	0984.8	8.3	11.7	4	8	23	12	21
TRANSCOLUMBIA	KPGG	13	31.4 N	43.5 W	12	18	20	10 NM	02	1016.9	18.9	18.9	5	16.5	31	7	41
SEALAND RESOURCE	WJMD	13	46.0 N	49.1 W	18	30	47	200 YD	22	0984.0	5.3	0.0	7	10			
AMERICAN ACE	KFCV	13	42.8 N	52.7 W	18	29	55	5 NM	26	1000.0	1.1	11.0	7	18			
SEALAND RESOURCE	WJMD	14	47.5 N	45.7 W	00	32	45	200 YD	22	0970.9	2.3	1.7					
TRANSCOLUMBIA	KPGG	14	36.6 N	46.0 W	06	31	45	10 NM	02	1015.5	17.7	18.8					
YOUNG AMERICA	WGLW	14	42.5 N	31.5 W	12	27	70	.5 NM	67	0985.0	12.7	11.7	5	6.5	19	8	10
AMERICAN ACE	KFCV	14	42.2 N	57.0 W	12	29	45	10 NM	02	1008.5	2.2	11.1	8	19.5			
AMERICAN ACE	KFCV	15	41.9 N	60.0 W	00	28	48	10 NM	02	1008.5	3.9	8.9	8	8			
TFL DEMOCRACY	9VPR	15	49.0 N	29.5 W	04	25	M 44	10 NM	92	0998.5	10.0	11.0					
YOUNG AMERICA	WGLW	15	47.9 N	38.4 W	12	28	50	10 NM	27	0992.5	11.7	13.3	6	18	28	9	32.5
OLIVE ACE	3EOR	15	40.7 N	29.9 W	18	21	M 42	5 NM	02	1008.0	13.0	13.0	5	8	21	12	24.5
AMERICAN ACCORD	KFEZ	15	47.7 N	39.3 W	18	24	42	5 NM	81	0983.2	5.6	13.3	6	18	24	>13	23
ASIAN HIGHWAY	JALK	16	56.9 N	20.2 W	06	16	M 42	5 NM	01	0993.0	8.0	11.0	7	8	20	7	11.5
ROBERT E LEE	KCPD	17	37.9 N	60.7 W	00	19	M 47	10 NM	25	1006.5	11.1	16.7	6	10	23	9	16.5
SEALAND PRODUCER	WJPJ	18	49.8 N	44.7 W	12	19	45	.5 NM	21	0989.5	10.6	10.0	9	14.5			
ASIAN HIGHWAY	JALK	18	49.3 N	41.4 W	18	17	M 52	.25 NM	10	0999.2	12.0	7.0	4	13	18	6	16.5
GREEN HARBOUR	KIBJ	20	34.6 N	70.2 W	12	02	M 49	2 NM	62	1000.7	15.6	17.8	6	8			
CHERRY VALLEY	WIRK	21	32.5 N	60.9 W	06	19	45	10 NM	01	1003.7	18.4	16.7	10	8	19	12	19.5
DYVI KATTEGAT	LMPR	21	49.8 N	18.8 W	12	21	M 50	.25 NM	64	1004.0	8.0						
AMERICAN ARCHER	KFCS	21	40.7 N	62.2 W	12	01	45	2 NM	02	0999.8	8.3	15.6	6	19.5			
ADM WM M CALLAGHAN	KGYE	21	37.5 N	57.9 W	18	27	70	.5 NM	07	0987.0	14.4	16.2	5	24.5	22	7	44
ARGONAUT	KFDV	22	38.5 N	45.8 W	06	20	55	5 NM	25	0995.6	16.1	17.2		19.5			
AMERICAN LEGACY	KFGJ	22	43.9 N	40.2 W	12	20	48	5 NM	02	0987.5	15.6	15.6	3	24.5	20	>13	29.5
DYVI KATTEGAT	LMPR	22	49.8 N	25.9 W	12	19	M 50	2 NM	02	1014.0	10.0						
SEALAND CONSUMER	WCHF	22	43.2 N	40.3 W	12	20	55	5 NM	02	0989.5	16.7	12.2	4	13	20	6	14.5
SEALAND ECONOMY	WNDJ	22	49.5 N	05.5 W	18	26	50	10 NM	02	1021.0	8.9	10.6	5	5	27	9	19.5
AMERICAN ARGOSY	KFCX	22	50.2 N	30.6 W	18	18	42	1 NM	61	0992.0	11.7	8.9	5	8	18	12	21
ARGONAUT	KFDV	23	38.2 N	48.4 W	00	32	35	5 NM	02	1016.6	14.4	17.8	5	19.5	28	8	36
DYVI KATTEGAT	LMPR	23	49.8 N	32.5 W	12	25	M 45	10 NM	02	1007.0	6.0						
DYVI KATTEGAT	LMPR	24	48.7 N	38.8 W	12	24	M 50	10 NM	01	1020.0	8.0						
AMERICAN ACE	KFCV	24	45.9 N	42.8 W	18	19	50	2 NM	63	1004.4	11.4	13.3	7	23	18	9	24.5
EXXON HUNTINGTON	KEAJ	25	36.9 N	74.3 W	18	02	45	5 NM	21	1009.8	9.8	13.3	4	6.5			
EXXON WASHINGTON	KIYN	26	34.3 N	76.1 W	12	27	50	10 NM	01	1006.8	4.0	20.0	6	10			
TEXACO MISSISSIPPI	KWEQ	26	34.8 N	75.6 W	15	30	M 48	< 50 YD	44	1011.9	7.5	20.0	4	6.5	30	8	8
AMERICAN ALLIANCE	KFEM	26	40.5 N	54.5 W	18	21	45	.5 NM	44	0996.0	17.8	16.8	6	16.5	22	6	16.5
OLGA MAERSK	OUXW	27	33.0 N	65.1 W	00	26	45	2 NM	25	1000.0	13.4			19.5			
OLEANDER	PJVG	27	36.0 N	68.5 W	00	33	41	5 NM	01	1006.1	10.0	15.6		19.5	XX		21
AMERICAN ACCORD	KFEZ	27	37.2 N	61.2 W	06	29	45	5 NM	80	1000.5	10.0	21.1	5	11.5	31	8	14.5
GULF TRADER	KRHI	28	36.1 N	54.9 W	18	19	30	10 NM	02	1016.0	17.3	17.8	XX	10	27	< 6	32.5
ULTRASEA	WJCG	28	44.3 N	52.8 W	18	13	45	5 NM	03	1007.5	5.5	0.5	6	8	15	8	14.5
GULF TRADER	KRHI	29	36.3 N	59.0 W	12	23	30	5 NM	60	1008.1	17.8	18.3	5	8	25	6	32.5
MORMACORACO	WMSD	29	34.1 N	64.2 W	18	26	45	5 NM	02	1010.5	20.1	18.9	5	6.5	26	< 6	14.5
SEALAND RESOURCE	WJMD	29	40.1 N	54.8 W	23	21	48	2 NM	15	0998.8	15.6	15.6	12	18	00		0
ENVIRONMENTAL BUOYS																	
41001		7	34.7 N	72.3 W	09	26	M 43			1005.6		18.2					
41001		26	34.7 N	72.3 W	15	26	M 46			999.4	8.1	17.9	7	16.5			
44004		7	39.0 N	70.0 W	18	35	M 51			993.0	5.6	12.4	11	31			
44004		8	39.0 N	70.0 W	00	35	M 44			1008.5	3.3	12.5	11	32.5			

\+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 32 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

Selected Gale and Wave Observations, North Pacific

January and February 1980

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves Period sec.	Sea Waves Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		JAN.															
NEW GOLDEN PHOENIX	3EVR	1	43.8 N	171.9 E	00	04	M 44	5 NM	51	0983.5	4.0	7.5	7	14.5	08	8	16.5
SKAUGRAN	LHUK	1	35.2 N	172.6 W	06	16	44	1 NM	64	1004.0	12.0		10	14.5			
HOEGH MINERVA	LIOL	1	38.8 N	173.6 E	06	27	M 42	5 NM	02	0995.0	12.0		10	19.5			
MASON LYKES	KNFN	1	30.5 N	173.5 W	12	21	45	5 NM	02	1000.1	17.8	18.3	3	8	19	6	11.5
ORIENTAL EXECUTIVE	DSAN	1	37.1 N	170.2 W	12	16	M 52	2 NM	18	1004.0	12.0						
CHEVRON ARIZONA	KGRE	1	23.5 N	150.3 W	12	26	M 50	5 NM	02	1000.0	22.3		8	16.5	25	12	23
CRESSIDA	3FTB	1	41.1 N	153.1 E	18	26	M 45	1 NM	85	1000.0	2.0	4.5	5	29.5			
CALIFORNIAN	KPZK	1	24.0 N	150.4 W	18	27	40	10 NM	03	1004.0	22.2	25.6	2	13	27	>13	39
PRESIDENT GRANT	WEZD	1	42.8 N	146.8 E	18	34	58	.25 NM	88	1009.1	- 6.6	1.1					
PRESIDENT GRANT	WEZD	2	42.4 N	144.6 E	00	34	44	10 NM	01	1022.7	- 0.6	1.7	4	5	33	8	10
PRESIDENT MADISON	WCIP	2	49.7 N	175.4 W	00	09	52	5 NM	02	0999.0	3.9	2.8	6	10	11	7	10
ADRIAN MAERSK	OYIT	2	42.0 N	165.7 W	00	16	48	2 NM	02	0996.5	11.0	7.0	8	24.5			
UNITED SEA ANGEL	3EEW	2	39.1 N	163.3 W	00	15	M 44	5 NM	02	1008.7	11.0	6.0	11	11.5	17	>13	13
WESER EXPRESS	DLDE	2	44.4 N	149.9 E	00	36	60	2 NM	15	1009.2	2.0	4.3	9	16.5			
ORIENTAL SOVEREIGN	ABUH	2	50.0 N	174.4 E	00	08	M 46	.5 NM	26	0991.9	4.0	3.0	6	29.5	08	6	29.5
CRESSIDA	3FTB	2	40.2 N	151.5 E	06	32	M 65	.5 NM	65	1005.0	3.0	8.0	5	32.5			
UNION PROGRESS	SMKP	2	29.4 N	139.5 W	12	13	M 45	.25 NM		1004.0	20.0	21.0					
UNIVERSE KURE	6ZAE	2	36.0 N	155.2 E	12	32	M 52	10 NM	80	1009.0	8.0	15.0	6	19.5	29	11	24.5
GEMINI PIONEER	5MRC	2	33.7 N	155.8 E	18	32	M 37	1 NM		1012.0	11.0	21.0	6	16.5	32	6	32.5
PRESIDENT VAN BUREN	WWPI	2	32.0 N	148.1 W	18	36	43	5 NM	21	1009.8	15.5	16.7	10	6.5	15	10	6.5
ARCO ALASKA	KSBK	2	50.4 N	134.7 W	18	29	M 57	2 NM	61	0993.0	7.8	7.2	13	32.5			
MOBILE MERIDIAN	KGSM	2	50.7 N	135.4 W	18	28	M 56	1 NM	82	0991.5	5.8	7.8	10	23			
SHUNWIND	ELIQ	2	51.4 N	136.0 W	21	29	M 56	5 NM	51	0997.5	6.0	8.0	8	16.5	29	9	32.5
SHUNWIND	ELIQ	3	51.6 N	136.3 W	00	29	M 47	5 NM	02	1003.0	5.5	8.0	8	16.5	29	9	39
PACIFIC ACE	H3YP	3	30.9 N	172.5 E	00	26	M 50	5 NM	01	0996.0	18.5	20.0	7	13	26	7	14.5
MOBILE MERIDIAN	KGSM	3	51.0 N	135.6 W	00	30	M 50	2 NM	02	1000.7	6.1	7.8	10	19.5			
ASIAN HIGHWAY	JKLK	3	29.4 N	170.0 E	00	27	M 50	5 NM	01	1000.0	17.0	20.0	5	13	27	9	23
ARCO ALASKA	KSBK	3	49.7 N	132.9 W	00	27	M 45	2 NM	07	1004.7	.	7.2	8	16.5			
FRANCIS SINCERE NO 6	SMCN	3	29.8 N	166.6 E	00	29	M 52	10 NM	01	1003.9	15.5	20.0	8	21	29	>13	21
PACPRINCESS	5LVG	3	47.0 N	128.9 W	00	25	30	5 NM	14	1015.0	10.0	9.0	25	8	25	13	32.5
PIONEER NO 1	JQAS	3	34.8 N	179.0 E	06	24	M 46	2 NM	62	0988.8	16.0	17.0	9	18	25	9	19.5
GEMINI PIONEER	5MRC	3	32.0 N	160.5 E	12	33	M 35	5 NM	02	1011.0	15.0	21.0	7	13	33	9	32.5
SIMBA	OWEC	3	40.8 N	179.6 W	18	25	M 44	5 NM	81	0979.8	8.5	12.0					
NOPAL VERDE	JXLM	3	39.5 N	170.6 W	18	18	50	1 NM	64	0996.4	15.5	13.0	8	11.5	18	10	14.5
GREAT OCEAN	JKJT	3	43.5 N	166.5 E	23	32	M 45	10 NM	02	1003.0	4.5	6.0	8	14.5	29	9	19.5
PRESIDENT JEFFERSON	WPGE	3	53.4 N	176.4 W	23	07	45	2 NM	53	0980.0	4.4	2.8	12	14.5			
ADRIAN MAERSK	OYIT	4	40.2 N	140.9 W	06	36	45	10 NM	02	1011.0	10.0		8	23			
HONSHU GLORIA	ABPJ	4	51.5 N	168.5 W	06	17	M 41	.5 NM	63	0987.0	6.5	3.0	4	8	18	< 6	8
ALLTRANS EXPRESS	9VPU	4	53.2 N	172.6 E	12	03	M 48	2 NM	07	0987.0	2.5	4.9					
PRESIDENT JEFFERSON	WPGE	4	52.2 N	174.3 E	18	34	45	5 NM	02	0982.7	3.3	2.8	12	26			
ORIENTAL EXECUTIVE	DSAN	4	36.5 N	141.0 W	18	32	M 45	5 NM	18	1003.0	10.0						
CELEBES	9VHD	4	40.4 N	140.9 W	18	36	45	2 NM	02	1003.0	10.0	9.0	6	8	36	6	16.5
YAMASHIN MARU	JBES	4	38.0 N	142.6 W	21	36	M 47	1 NM	02	1007.5	10.0	13.0	3	13	02	8	14.5
YAMASHIN MARU	JBES	5	37.2 N	142.5 W	00	36	M 46	1 NM	50	1004.0	10.5	14.0	3	13	03	8	16.5
SINCERE NO 3	ELRT	5	37.3 N	144.5 E	00	35	M 44	2 NM	80	1006.0	6.0	18.0	3	26	17	6	16.5
PACPRINCESS	5LVG	5	43.6 N	139.2 W	00	05	41	2 NM	01	1016.5	8.0	10.0			05	9	32.5
UNITED SEA ANGEL	3EEW	5	36.8 N	143.5 W	00	36	M 50	1 NM	53	1006.5	10.5	9.0	11	10	01	>13	24.5
HONSHU GLORIA	ABPJ	5	50.9 N	172.1 W	00	20	M 42	5 NM	03	0988.0	5.0	35.0	5	10	20	< 6	11.5
PRESIDENT JEFFERSON	WPGE	5	51.5 N	171.5 E	00	34	50	5 NM	51	0998.5	1.1	2.8	14	23			
CELEBES	9VHD	5	38.6 N	140.5 W	06	02	54	1 NM		0998.0	12.5	12.0	3	8	36	6	19.5
GREAT OCEAN	JKJT	5	42.4 N	154.1 E	11	31	M 45	5 NM	58	0999.8	8.0	8.0	8	16.5	33	9	16.5
TOYOTA MARU 12	JBJO	5	38.6 N	146.2 W	12	02	M 43	2 NM	00	1014.5	11.0	12.0	10	16.5	02	>13	24.5
ALLTRANS EXPRESS	9VPU	5	49.1 N	161.0 E	18	15	M 49	5 NM	02	0991.0	4.5	3.5					
PRINCE WILLIAM SOUND	WSDX	5	44.8 N	128.5 W	18	01	M 42	> 25 NM	01	1022.9	7.5	11.7	7	16.5			
PRESIDENT JEFFERSON	WPGE	6	48.5 N	161.6 E	00	16	50	2 NM	63	0987.5	3.9	1.7	12	19.5	XX		23
PRESIDENT TAFT	WLDT	6	40.7 N	143.5 W	00	06	45	5 NM	02	1019.0	10.0	9.4	4	18	06	8	32.5
SKAUGRAN	LHUK	6	34.8 N	146.3 W	00	05	45	2 NM	25	1005.0	12.5	17.0	12	29.5			
ALLTRANS EXPRESS	9VPU	6	48.7 N	158.7 E	00	29	M 50	.5 NM	86	0995.5	- 2.0	2.0			32	9	10
UNITED SEA ANGEL	3EEW	6	33.5 N	139.3 W	00	08	M 42	1 NM	81	0995.5	15.2	12.0	10	10	08	10	13
TOYOTA MARU 12	JBJO	6	36.2 N	145.5 W	00	02	M 44	1 NM	02	1006.0	12.5	15.0	8	16.5	02	>13	29.5
AMERICAN APOLLO	KEOD	6	40.3 N	140.8 W	06	04	45	5 NM	02	1016.5	11.8	12.8			04	6	18
SEALAND FINANCE	WJKG	6	32.8 N	156.5 E	06	36	45	10 NM	25	1015.0	11.6	18.3	8	13	36	8	13
PACIFIC VENTURE	HOVS	6	37.2 N	168.2 E	12	33	M 55	5 NM	65	1001.4	10.0	14.0	10	21	33	12	24.5
PRESIDENT JOHNSON	WVHS	6	40.5 N	166.7 E	18	36	41	10 NM	02	1009.0	6.1	12.2	9	14.5			
PRESIDENT JEFFERSON	WPGE	7	44.1 N	153.1 E	00	15	45	5 NM	53	1005.0	5.1	2.2	12	16.5			
PACIFIC VENTURE	HOVS	7	37.0 N	164.5 E	00	35	M 52	5 NM	64	1012.7	7.0	16.0	10	24.5	35	12	26
SPRUCE	JPOP	7	36.7 N	146.3 E	00	25	M 55	10 NM	03	1000.2	16.5	19.0	4	14.5	05	< 6	24.5
ASIAN HIGHWAY	JKLK	7	34.5 N	140.1 E	00	27	M 43	5 NM	02	1005.5	13.0	21.0	4	10	27	< 6	10
SEATRAIN YORKTOWN	DSNP	7	36.3 N	169.6 E	06	08	M 43	2 NM	51	0992.8	14.0	16.0	7	11.5	26	7	23
SEALAND FINANCE	WJKG	7	34.4 N	143.0 E	06	35	45	10 NM	25	1004.0	12.3	18.3	12	24.5	28	12	24.5
HOEGH MIRANDA	LICZ	7	35.2 N	168.5 E	06	33	M 50	2 NM	81	0996.5	11.1	16.2	12	26			
PACIFIC ACE	H3YP	7	33.4 N	150.1 E	12	30	M 43	1 NM	81	1004.0	16.0	21.0	6	10	17	6	11.5
LIPSCOMB LYKES	WLDL	7	31.4 N	171.7 E	18	32	40	5 NM	62	0995.0	14.0	18.9	7	32.5			
WORLD PRIDE	SLGD	7	36.5 N	150.4 E	18	33	45	2 NM	02	1006.0	7.0	21.0	8	41			
ALLTRANS EXPRESS	9VPU	8	41.6 N	141.8 E	00	30	M 58	5 NM	01	1018.3	- 3.0	12.8			29	8	8
PRESIDENT JEFFERSON	WPGE	8	39.3 N	146.4 E	00	30	50	10 NM	01	1011.5	0.6	7.8	11	16.5			
WORLD PRIDE	SLGD	8	36.6 N	153.3 E	06	29	40	5 NM	27	1006.0	6.0	21.0	8	41	32	10	42.5
SEAWAY DISPATCH	DDFY	8	29.8 N	176.7 W	06	35	45	10 NM	02	0984.5	15.0	20.0			30		23
PACIFIC VENTURE	HOVS	8	36.3 N	155.0 E	06	32	M 55	2 NM	03	1000.2	9.0	16.0	11	23	32	11	24.5
SPRUCE	JPOP	8	38.0 N	158.2 E	12	33	M 47	2 NM	01	1003.0	6.0	16.5	5	13	13	< 6	19.5
HONSING ARROW	3EKE	8	33.9 N	163.9 E	21	32	M 50	5 NM	03	1002.5	11.0	17.0			32	6	29.5
HONSING ARROW	3EKE	9	33.8 N	163.6 E	00	32	M 55	2 NM	82	1005.5	11.0	18.0			32	6	32.5
WORLD PRIDE	SLGD	9	36.6 N	157.9 E	00	33	35	10 NM	23	1011.0	7.0	16.0	7	57	33	10	49
AMERICA SUN	WNEJ	9	53.3 N	138.2 W	06	02	M 50	5 NM	60	1020.0	3.5	5.6	4	5	02	8	11.5
SEATRAIN YORKTOWN	DSNP	9	34.8 N	159.5 E	06	31	M 46	10 NM	27	1010.5	10.0	19.0	14	32.5	33	>13	32.5
GIBRALTAR	JPTL	9	40.2 N	152.5 W	12	08	M 41	2 NM	61	1002.5	11.0	10.0	16	21	04	8	18
PRESIDENT MADISON	WCIP	9	52.8 N	142.1 W	12	04	50	10 NM	02	1024.0	3.3	4.4	4	3	04	9	11.5
HONSHU GLORIA	ABPJ	9	45.9 N	155.5 E	18	29	M 46	10 NM	64	1008.0	- 4.0	3.0					
SPRUCE	JPOP	9	35.1 N	166.4 E	18	31	M 43	5 NM	01	1008.5	8.5	18.0	6	13	13	12	19.5
HONSHU GLORIA	ABPJ	10	45.6 N	154.2 E	00	31	M 42	2 NM	86	1011.5	- 4.0	4.0	4	6.5	30	< 6	8
SEATRAIN CHESAPEAKE	DSOC	10	35.1 N	147.3 E	08	10	M 65	2 NM	60	0988.0	13.0	19.0	9	21	00		0
ATLANTIC PIONEER	H3WN	10	52.3 N	153.7 W	06	32	M 45	.5 NM	03	1016.5	5.0						
GIBRALTAR	JPTL	10	40.0 N	153.0 W	06	08	M 60	1 NM	21	0989.0	10.0	9.5	13	32.5	09	12	28
OVERSEAS CHICAGO	KBCF	10	47.2 N	131.9 W	12	29	45	10 NM	01	1001.0	6.8	10.0	5	19.5	30	6	23

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves† Period sec.	Sea Waves† Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		JAN.															
WORLD PRIDE	5LGO	10	36.6 N	167.3 E	12	32	30	5 NM	03	1011.0	6.0	17.0	6	13	32	8	32.5
HOEGH MIRANDA	LIOZ	10	33.6 N	152.2 E	12	26	M 48	2 NM	82	0997.0	17.5						
MOBIL ARCTIC	KSPY	10	58.0 N	140.5 W	12	09	M 55	1 NM	73	0990.9	- 1.5	4.5	7	8	09	7	10
ORIENTAL IMPORTER	VPFW	10	36.8 N	150.5 E	18	32	50	2 NM	01	0986.0	12.0	17.0	8	13	06	< 6	13
PRESIDENT TYLER	WEZM	10	36.8 N	165.0 W	18	24	16	5 NM	01	0980.0	12.0	12.2	2	3	03	8	36
LIPSCOMB LYKES	WLDL	10	33.0 N	149.5 E	18	27	45	5 NM	01	1002.0	16.7	17.8	8	24.5	22	8	24.5
OGDEN CONGO	A8IP	10	21.5 N	159.7 W	18	23	M 41	2 NM	81	1004.0	23.0	23.0	7	11.5	23	>13	19.5
SEATRAIN VALLEY FORGE	9VPV	10	35.4 N	177.4 W	18	30	M 45	2 NM	63	0984.7	12.0	16.0	5	6.5	07	8	3
SEATRAIN YORKTOWN	D5NP	10	35.9 N	152.0 E	18	26	M 65	10 NM	01	0987.0	15.0	19.0	10	39	26		39
APOLLO	ELEN	10	43.1 N	167.0 W	18	09	M 50	2 NM	10	1009.5	7.8	9.0					
SEATRAIN YORKTOWN	D5NP	11	35.9 N	151.6 E	00	28	M 60	10 NM	02	0999.3	13.8	19.0	10	42.5	27		42.5
OVERSEAS CHICAGO	KBCF	11	49.4 N	134.0 W	00	24	45	10 NM	02	0993.5	6.0	8.0	5	19.5	27	>13	29.5
GLACIER BAY	KACF	11	21.9 N	157.8 W	00	24	45	5 NM	02	1000.7	24.4	21.1	5	19.5			
SILVER STAR	JKIQ	11	34.0 N	149.0 E	00	32	M 45	2 NM	02	1004.0	15.8	2.0	7	3	32	7	16.5
HOMSING ARROW	3ENE	11	34.4 N	154.9 E	00	27	M 50	5 NM	25	0998.0	13.5	19.0			27	6	36
PACBARON	A8YI	11	36.1 N	148.9 E	00	34	M 46	2 NM	21	1001.0	12.0	19.0	8	13	33	10	14.5
LIPSCOMB LYKES	WLDL	11	33.4 N	150.4 E	00	27	45	5 NM	02	1003.5	16.7	17.8	9	32.5	30	11	41
PRESIDENT TYLER	WEZM	11	36.8 N	163.3 W	00	24	15	10 NM	02	0979.5	14.4	12.2	2	3	03	8	34.5
HOEGH MIRANDA	LIOZ	11	34.2 N	152.5 E	00	27	M 50	2 NM	81	1000.0	16.0	18.3	4	13	27	9	26
SILVER PHOENIX	D5NW	11	49.3 N	132.7 W	03	24	M 42	5 NM	21	0993.6	6.5	7.0	7	11.5	29	8	16.5
MARCONA EXPORTER	ELEC	11	33.6 N	176.4 W	06	31	43	5 NM	02	0991.0	13.0	16.0	7	11.5	31	9	14.5
NORSE PILOT	GOVQ	11	34.7 N	150.1 E	06	30	M 48	10 NM	25	1003.3	12.0	18.0	3	8	30	9	42.5
ORIENTAL IMPORTER	VPFW	11	37.2 N	154.6 E	06	27	55	2 NM	02	0985.0	14.0	18.0	8	16.5	27	6	16.5
ANNA MAERSK	OYKS	11	35.4 N	149.5 E	06	33	44	10 NM	02	1004.8	11.4		1	23			
SEATRAIN VALLEY FORGE	9VPV	11	34.2 N	179.8 W	06	30	M 45	5 NM	15	0997.0	14.0	16.0	5	8	30	8	16.5
OGDEN CONGO	A8IP	11	21.6 N	162.2 W	09	26	M 42	5 NM	01	1008.0	24.0	24.0			26	12	29.5
PRESIDENT POLK	WNEI	11	34.9 N	148.9 E	18	33	45	10 NM	02	1013.6	7.2	18.9	6	13	01	6	19.5
SEATRAIN CHESAPEAKE	D5QC	11	35.4 N	163.5 E	23	28	M 44	5 NM	01	0994.5	15.5	17.0	9	19.5	27	12	19.5
NORSE PILOT	GOVQ	12	33.3 N	154.4 E	00	32	M 30	10 NM	02	1009.5	13.4	18.0	3	18	31	8	32.5
LIPSCOMB LYKES	WLDL	12	32.2 N	146.2 E	00	34	25	10 NM	25	1021.8	11.7	17.8	7	13	33	11	32.5
PRESIDENT POLK	WNEI	12	34.4 N	153.6 E	06	31	45	10 NM	15	1012.2	10.6	17.8	6	13	31	6	19.5
HILLYER BROWN	KNLA	12	42.8 N	125.2 W	06	18	48	10 NM	52	0987.3	13.2	12.2	4	11.5			
ANNA MAERSK	OYKS	12	36.1 N	160.0 E	06	33	45	5 NM	80	0996.2	10.2	17.0	4	23			
ARTHUR MAERSK	OXRS	12	42.3 N	160.8 E	06	04	42	2 NM	51	0992.6	5.0			26			
SILVER STAR	JKIQ	12	33.6 N	157.0 E	06	33	M 45	5 NM	25	1008.0	14.0	2.0	10	10	33	11	14.5
EASTERN DIAMOND	HODT	12	37.4 N	159.9 E	08	32	M 60	1 NM	55	0987.5	10.0	10.0	6	32.5	32	< 6	23
ACE ENTERPRISE	JBMT	12	53.8 N	155.8 W	12	32	M 45	.25 NM	07	0985.0	.	3.5					
TOYOTA MARU 12	JBJO	12	40.7 N	127.0 W	12	22	M 45	5 NM	00	0991.5	15.0	13.5					
PRESIDENT HOOVER	WTST	12	40.1 N	159.2 E	12	34	50	5 NM	02	0999.0	4.4	10.6	3	32.5			
ORIENTAL IMPORTER	VPFW	12	37.0 N	168.5 E	18	25	50	2 NM	60	0978.0	10.0	15.0	7	14.5	25	8	16.5
SEALAND ADVENTURER	KSLJ	12	36.4 N	166.8 E	18	30	M 58	5 NM	50	0987.5	11.0	14.0					
MOBILE MERIDIAN	KGSM	12	48.9 N	126.3 W	18	30	M 42	5 NM	02	0973.5	6.6	8.9	7	14.5	22	10	10
SEATRAIN VALLEY FORGE	9VPV	12	30.0 N	170.0 E	18	30	M 42	5 NM	25	1004.0	15.0	19.0	5	6.5	30	7	23
MOBILE MERIDIAN	KGSM	13	49.6 N	127.8 W	00	27	M 50	5 NM	02	0988.8	4.4	9.4	5	14.5	27	6	14.5
SILVER STAR	JKIQ	13	33.2 N	161.5 E	00	32	M 45	10 NM	02	1014.3	14.8	19.5	10	8	32	12	23
QUEENS WAY BRIDGE	JHJE	13	37.1 N	170.4 W	00	11	M 41	2 NM	02	1002.0	13.0	14.0	6	10	08	10	16.5
ORIENTAL IMPORTER	VPFW	13	37.1 N	169.5 E	00	25	47	5 NM	07	0979.0	14.0	14.0	6	13	25	9	16.5
ANNA MAERSK	OYKS	13	34.9 N	166.8 E	00	29	45	5 NM	81	0997.6	13.0		4	32.5	29		32.5
SOUTH EXPRESS	A8WR	13	53.2 N	146.3 W	00	27	M 40	5 NM	85	0969.0	- 1.5	7.0	5	32.5	28	10	16.5
SEALAND ADVENTURER	KSLJ	13	36.1 N	167.9 E	06	30	M 55	5 NM	50	0996.6	12.0	17.0	3	14.5	30	11	31
SEATRAIN ORISKANY	D5OM	13	31.0 N	172.2 E	06	26	M 42	10 NM	02	1005.0	15.0	18.0	6	19.5	29	< 6	26
ARTHUR MAERSK	OXRS	13	34.9 N	148.8 E	18	17	45	2 NM	63	0988.4	14.4						
PRESIDENT HOOVER	WTST	13	37.6 N	149.5 E	18	15	M 55	2 NM	64	0988.8	4.4	16.2		29.5	XX		26
EASTERN DIAMOND	HODT	13	35.7 N	154.2 E	20	35	M 45	5 NM	03	1004.5	10.0	15.0	4	24.5	35	6	23
EASTERN DIAMOND	HODT	14	35.7 N	153.3 E	00	21	M 45	5 NM	03	0998.0	18.0	15.0	5	23	21	6	23
PRESIDENT HOOVER	WTST	14	37.5 N	149.2 E	00	29	M 45	2 NM	16	0992.9	11.2	19.4	XX	29.5			
UNIVERSE KURE	6ZAE	14	37.5 N	151.2 E	00	26	M 42	2 NM	62	0993.0	14.5	19.0	6	11.5	26	7	16.5
SOUTH EXPRESS	A8WR	14	53.8 N	153.7 W	06	28	M 35	200 YD	85	0974.0	- 8.0	5.0	8	32.5	29	10	19.5
PRESIDENT MADISON	WCIP	14	44.2 N	152.8 E	06	11	50	2 NM	26	0988.3	11.0	0.6	10	23			
PRESIDENT MADISON	WCIP	15	42.4 N	149.8 E	00	25	45	10 NM	02	0994.0	2.2	2.7	8	5	25	8	8
KOFUKU MARU	JKLB	15	51.8 N	147.6 W	00	26	M 42	2 NM	04	0977.5	- 3.0	5.5	6	11.5	26	6	11.5
GARDENIA	A8UA	15	46.2 N	153.6 E	06	20	M 45	200 YD	93	0998.6	0.0	2.0	11	19.5	20	>13	16.5
GOLDEN SABRE	SMOJ	15	33.9 N	146.4 E	06	29	M 35	10 NM	02	1006.6	13.0	21.0	5	10	29	9	36
SOUTH EXPRESS	A8WR	15	53.9 N	159.7 W	12	30	M 55	200 YD	86	0986.5	- 9.0	4.5					
PACIFIC VENTURE	HOVS	16	35.8 N	180.0 W	12	28	M 45	5 NM	13	0996.0	12.0	16.0	12	21	27	12	21
SHUNWIND	ELIQ	16	36.2 N	132.9 E	12	28	M 42	10 NM	02	1017.9	4.5	14.0	7	13	26	8	16.5
FRIENDSHIP	ELXP	16	34.7 N	168.1 W	18	22	M 41	1 NM	50	0994.0	14.5	17.0	4	10	20	7	11.5
SANKO MAPLE	D5NG	17	37.4 N	176.5 W	00	26	M 45	2 NM	21	0993.3	10.0	14.0	10	19.5	26	10	26
GARDENIA	A8UA	17	41.3 N	147.0 E	03	26	M 51	2 NM	00	1001.0	3.0	4.0	7	26	26	11	31
PRESIDENT FILLMORE	KRDH	17	39.4 N	170.9 W	06	26	50	5 NM	01	0982.4	13.3	10.6	8	23	26	10	32.5
SUNWARD	ELZT	17	50.7 N	133.0 W	06	28	44	10 NM	01	1021.0	6.0	5.0	5	19.5	29	7	28
ALLTRANS ENTERPRISE	9VVD	17	35.4 N	171.8 W	12	28	M 48	5 NM	03	0995.5	12.0	14.0					
ARCTIC TOKYO	SLJT	17	54.3 N	165.1 W	12	04	M 50	2 NM	02	0972.0	3.0	0.0	2	8			
SEALAND ADVENTURER	KSLJ	17	34.4 N	144.3 E	18	28	M 58	5 NM	01	1003.2	13.0	19.0	7	11.5	28	7	11.5
PACIFIC VENTURE	HOVS	17	36.4 N	169.1 W	18	28	M 45	5 NM	81	0995.2	12.0	6.0	12	21	28	12	24.5
AMERICA MARU	JNXV	17	49.9 N	150.6 W	18	15	M 46	.5 NM	03	0994.8	6.9	6.0	4	8	15	12	19.5
ALLTRANS ENTERPRISE	9VVD	18	35.2 N	167.5 W	00	27	M 46	10 NM	03	0998.0	14.5	14.0	5	13	27	9	18
PACIFIC VENTURE	HOVS	18	35.9 N	166.8 W	00	29	M 48	5 NM	02	0996.0	14.0	14.0	12	23	27	13	23
SANKO MAPLE	D5NG	18	38.4 N	169.9 W	00	28	M 44	2 NM	18	0989.0	11.0	14.0	10	32.5			
OCEAN DUKE	D7OM	18	52.8 N	151.7 W	00	14	M 50	1 NM	02	0980.0	6.0	5.0	5	26	14	< 6	29.5
PRESIDENT PIERCE	WUBY	18	49.7 N	138.8 W	00	18	45	10 NM	02	1020.7	7.5	4.7	6	10	18	7	13
GARDENIA	A8UA	18	39.3 N	143.5 E	00	27	M 40	2 NM	03	1005.0	5.0	13.0	8	32.5	27	11	32.5
CHESNUT HILL	WVFX	18	27.6 N	169.4 W	06	25	25	10 NM	00	1010.0	19.5	19.5			28	10	32.5
SILVER PHOENIX	D5NW	18	40.1 N	125.7 W	06	36	M 46	10 NM	02	1020.3	10.5	10.0	7	16.5	31	10	18
FRIENDSHIP	ELXP	18	35.2 N	174.3 W	06	30	M 41	5 NM	25	0998.0	12.0	16.0	5	13	32	8	18
SUNWARD	ELZT	18	51.9 N	139.0 W	06	16	42	10 NM	02	1019.5	8.0	4.0	5	18	17	< 6	26
EVER SPRING	H3WZ	18	33.8 N	142.8 E	06	30	M 47	10 NM	03	1015.0	12.0	17.5	4	23	33	8	19.5
LIONS GATE BRIDGE	JCLL	18	53.7 N	155.7 W	12	13	M 47	5 NM	02	0971.0	5.0		3	8	17	8	16.5
WORLD PRIDE	5LGO	18	44.5 N	145.8 E	12	13	40	.25 NM	15	0991.0	12.0	11.0	8	32.5			
OGDEN CONGO	A8IP	18	32.1 N	161.7 E	18	27	M 47	5 NM	02	1003.0	16.0	18.0					
SEALAND LEADER	WSNH	18	35.1 N	176.2 E	18	23	M 47	10 NM	03	0999.3	17.0	14.0	5	10	23	8	26
ALEUTIAN DEVELOPER	WIPL	18	52.8 N	143.6 W	18	15	M 45	2 NM	53	0998.5	8.3	3.3	5	11.5	16	10	16.5
ORIENTAL IMPORTER	VPFW	18	45.5 N	138.0 W	18	16	54	2 NM	12	1009.0	10.0	10.0	6	16.5	16	7	16.5
BELLMAN	9VUP	18	52.3 N	142.7 W	18	16	M 43	2 NM	60	1005.0	7.0	7.5	5	10	19	6	19.5

Vessel	Nationality	Date	Position of Ship: Lat. deg.	Position of Ship: Long. deg.	Time GMT	Wind: Dir. 10°	Wind: Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C: Air	Temperature °C: Sea	Sea Waves: Period sec.	Sea Waves: Height ft.	Swell Waves: Dir. 10°	Swell Waves: Period sec.	Swell Waves: Height ft.
NORTH PACIFIC OCEAN		JAN.															
SEATRAIN INDEPENDENCE	DSKL	18	33.3 N	167.6 W	19	29	50	5 NM	02	0995.5	14.0	14.0	8	13	28	11	16.5
SANKOSTAR	SMHS	19	48.1 N	146.6 W	00	17	M 28	2 NM	27	0989.5	9.0	8.0	12	46	17	12	46
ALEUTIAN DEVELOPER	WIPL	19	52.4 N	144.4 W	00	14	M 45	2 NM	02	0985.4	7.3	3.4	5	11.5	14	9	16.5
PRESIDENT TAFT	WLDT	19	28.0 N	156.9 W	00	27	45	5 NM	02	1005.8	18.3	18.3	5	14.5	27	7	32.5
SILVER STAR	JKIQ	19	32.7 N	159.3 W	00	31	M 47	5 NM	02	1001.5	20.0	18.0	4	5	31	7	10
BELLMAN	9VUP	19	52.6 N	144.5 W	00	16	M 50	1 NM	61	0986.0	9.0	5.0	5	11.5	16	8	23
SEATRAIN YORKTOWN	DSNP	19	34.2 N	154.2 E	00	32	M 42	10 NM	02	1010.2	11.4	17.0	7	13	32	13	16.5
MOBILE MERIDIAN	KGSM	19	57.0 N	140.6 W	05	13	M 51	2 NM	82	1004.9	4.5	5.5	7	34.5	28	10	24.5
GLACIER BAY	KACF	19	31.0 N	156.0 W	06	28	45	5 NM	01	1002.3	15.6	15.6	4	16.5	28	7	34.5
PHILADELPHIA	WJBO	19	55.4 N	139.2 W	06	14	45	10 NM	20	1007.8	5.0	8.9	6	24.5	14	8	41
SEALAND COMMERCE	WEUJ	19	30.3 N	162.9 W	06	29	46	5 NM	62	1005.2	13.9	16.2	8	23	29	12	36
SEALAND LEADER	WSNH	19	35.0 N	179.9 W	06	23	M 42	5 NM	25	0998.8	13.0	16.0	8	10	23	8	26
OCEANOGRAPHER	WTEP	19	30.6 N	154.6 W	06	31	M 44	10 NM	19	1003.7	16.0	18.2	7	26	23	7	10
ORIENTAL IMPORTER	VPFW	19	46.8 N	133.4 W	06	16	55	2 NM	12	1017.0	9.0	10.0	6	16.5	16	6	16.5
OGDEN CONGO	ABIP	19	32.2 N	160.5 E	06	30	M 46	5 NM	80	1009.0	8.0	18.0	5	29.5	30	>13	32.5
VIOLET	ABZH	19	36.1 N	153.3 E	06	35	M 41	10 NM	03	1014.0	10.0	19.0	7	11.5	35	8	11.5
PACIFIC SAGA	5MFK	19	29.1 N	153.3 W	12	29	45	5 NM	01	1008.0	18.0	18.0	10	19.5	29	12	19.5
MAYA PIONEER	JLAX	19	36.5 N	172.6 E	18	32	M 45	50 YD	12	0994.0	8.0	18.0	8	8	32	< 6	8
SUNWARD	ELZT	19	53.4 N	149.5 W	18	27	49	10 NM	03	0996.1	3.0	2.0	5	18	27	6	31
SANKOSTAR	SMHS	20	50.0 N	153.6 W	00	13	M 32	5 NM	03	0999.3	7.0	7.0	10	42.5	13	11	42.5
CHESNUT HILL	WVFX	20	26.1 N	178.9 E	00	28	25	10 NM	03	1088.0	22.2	18.9	8	13	29	8	36
CONTINENTAL FRIENDSHIP	6ZMN	20	29.0 N	175.0 E	00	30	M 43	5 NM	02	1011.5	17.5	19.0	3	11.5	34	6	14.5
GENISTA	ABCY	20	49.8 N	160.2 W	03	05	M 50	.5 NM	84	0997.6	1.0	3.0	4	29.5			
SEATRAIN INDEPENDENCE	DSKL	20	32.2 N	175.7 W	04	27	47	5 NM	81	0993.0	14.0	16.0	9	14.5			
ALEUTIAN DEVELOPER	WIPL	20	54.6 N	157.0 W	12	09	M 47	2 NM	26	0968.5	2.7	1.2	5	10	09	8	16.5
ALASKA STANDARD	WHDN	20	55.7 N	158.8 W	12	05	45	1 NM	86	0977.0	- 5.0	5.5	5	14.5			
SUNWARD	ELZT	20	53.9 N	154.7 W	12	17	46	2 NM	58	0971.0	7.5	2.5	4	23	18	6	28
VAN ENTERPRISE	H8JO	20	49.4 N	155.7 W	18	22	M 45	5 NM	62	0987.0	4.0	3.0					
PIONEER NO 3	JQEF	20	33.2 N	171.1 W	18	33	45	10 NM	03	1004.6	12.5	17.0	2	19.5	29	12	19.5
SEALAND COMMERCE	WEUJ	20	32.6 N	150.3 E	18	22	45	5 NM	13	0999.3	14.4	15.6	9	19.5	20	10	23
OGDEN CONGO	ABIP	20	33.1 N	152.2 E	21	27	M 42	2 NM	81	1004.0	16.0	18.0	8	16.5	27	>13	19.5
SANKOSTAR	SMHS	21	51.3 N	159.3 W	00	25	M 42	5 NM	03	0998.9	4.0	5.0	12	49	25	12	49
PACIFIC SAGA	5MFK	21	28.9 N	160.9 W	00	28	44	5 NM	02	1006.5	20.0	18.0	6	13	27	7	23
SOHIO INTREPID	KACK	21	56.6 N	147.2 W	00	16	45	2 NM	10	1000.0	5.6	6.7	2	8	16	8	26
PIONEER NO 3	JQEF	21	33.2 N	171.5 W	00	33	45	10 NM	03	1009.0	13.5	17.0	7	19.5	30	7	23
SUNWARD	ELZT	21	53.9 N	159.4 W	00	26	53	10 NM	03	0978.0	3.0	1.0	4	29.5	25	6	36
CRYSTAL STAR	DSTG	21	38.9 N	159.6 E	00	18	M 45	5 NM	02	0996.0	14.0	14.0	4	6.5	17	< 6	10
MOBILE MERIDIAN	KGSM	21	52.6 N	133.4 W	05	13	M 41	10 NM	02	1019.5	6.3	6.7	4	14.5	18	10	5
SEALAND COMMERCE	WEUJ	21	33.7 N	145.1 E	06	27	42	5 NM	18	1000.5	9.4	15.7	14	16.5	27	12	36
OGDEN CONGO	ABIP	21	33.3 N	149.6 E	12	27	M 46	10 NM	03	1005.0	14.0	18.0			27	>13	29.5
HONSHU GLORIA	ABPJ	21	43.4 N	173.0 E	18	17	M 40	.5 NM	25	0994.0	7.0	7.0	6	11.5	18	6	11.5
HONSHU GLORIA	ABPJ	22	43.5 N	174.7 E	00	21	M 43	2 NM	63	0992.5	10.0	8.0	7	11.5	20	8	13
OCEAN DUKE	DTOM	22	50.2 N	172.6 E	00	11	M 45	.25 NM	10	0993.0	8.5	6.0	5	5	13	10	16.5
EVER SPRING	H3WZ	22	36.4 N	175.9 E	06	20	M 42	10 NM	04	1004.0	15.2	15.0	4	16.5	17	< 6	21
SOUTH EXPRESS	ABWR	22	44.4 N	152.5 E	12	29	M 41	.25 NM	86	0994.0	- 1.0	5.0	8	23	29	7	23
SUNWARD	ELZT	23	53.7 N	174.8 W	00	14	44	10 NM	03	1002.8	6.8	1.0	4	19.5	13	6	26
VIOLET	ABZH	23	45.1 N	170.0 W	18	16	M 60	1 NM	10	0994.0	9.8	11.8					
HONSHU GLORIA	ABPJ	23	46.1 N	173.8 W	18	21	M 48	1 NM	28	0984.5	9.5	7.0	7	10	18	7	10
WESER EXPRESS	DLDE	23	37.3 N	152.7 W	18	33	44	5 NM	20	1010.5	10.2	12.2	5	11.5	35	9	19.5
SEALAND FINANCE	WJKG	23	49.3 N	168.5 W	18	20	45	1 NM	42	0999.8	5.1	4.4	6	11.5	20	8	16.5
SILVER PHOENIX	DSNW	23	53.9 N	176.1 W	21	12	M 42	1 NM	61	0978.0	2.5	2.5	8	16.5	12	8	13
DAFFODIL	H3AG	24	52.3 N	167.4 W	00	15	M 45	2 NM	47	1002.5	7.0	0.4	8	10	15	8	14.5
SEALAND FINANCE	WJKG	24	49.9 N	165.0 W	00	15	60	1 NM	44	1007.0	4.4	3.3	12	19.5	15	12	19.5
SIENA	OXFU	24	45.7 N	151.5 W	00	07	M 41	2 NM	03	1016.6	5.8	13.5	7	18			
ORIENTAL SOVEREIGN	ABUH	24	52.5 N	172.1 W	00	15	M 49	5 NM	05	0981.0	4.0	4.5	10	11.5	15	10	11.5
VIOLET	ABZH	24	45.1 N	168.7 W	00	16	M 53	.5 NM	59	0998.0	7.0	6.0	11	26	16	13	26
SOUTH EXPRESS	ABWR	24	39.6 N	146.0 E	00	28	M 45	5 NM	02	1001.5	5.0	14.0	6	13	28	7	26
SUCCESSFUL VENTURE	SLKJ	24	54.4 N	165.8 W	00	15	M 52	2 NM	44	1008.0	3.2	4.0	3	5	30	< 6	26
PRESIDENT KENNEDY	KCAK	24	33.5 N	144.0 E	01	25	50	2 NM	25	1009.0	12.8	17.8	5	8	23	8	10
AMERICAN CHARGER	KGTR	24	31.9 N	129.1 E	06	32	M 20	5 NM	05	1019.8	15.0	89.0	2	3			
ARCTIC TOKYO	SLJT	24	53.4 N	176.6 E	06	27	M 65	5 NM	02	0973.0	1.0	0.0	3	10			
FALSTRIA	OYBG	24	14.6 N	95.9 W	06	03	M 42	> 25 NM	04	1010.7	25.0		3	6.5			
SEALAND MCLEAN	WHBA	24	53.8 N	177.1 E	06	26	47	5 NM	24	0970.0	1.1	2.2	10	16.5			
PRESIDENT JEFFERSON	WPGE	24	50.0 N	144.3 W	06	09	50	10 NM	02	1030.1	6.1	5.0	7	13			
VAN CONQUEROR	ABIB	24	41.2 N	150.7 E	12	30	M 44	1 NM	23	0995.0	- 1.0	8.0					
SUNWARD	ELZT	24	50.7 N	175.4 E	12	26	60	10 NM	02	0987.0	2.0	1.0	4	29.5	25	8	37.5
HONSHU GLORIA	ABPJ	25	47.3 N	163.6 W	06	29	M 43	> 25 NM	03	1004.0	4.5	6.0	5	11.5	29	6	11.5
PRESIDENT TYLER	WEZM	25	49.5 N	163.9 E	12	19	40	5 NM	02	0963.5	0.6	1.7	6	19.5	13	10	36
SUNWARD	ELZT	25	50.3 N	171.5 E	12	13	47	10 NM	58	0992.0	5.5	1.5	4	24.5	22	6	28
PRESIDENT ADAMS	KABV	25	49.3 N	173.5 E	18	11	50	2 NM	63	0989.5	3.3	2.2	8	19.5	XX		23
ORIENTAL SOVEREIGN	ABUH	26	52.1 N	172.2 E	00	12	M 41	.25 NM	73	0992.2	2.5	3.0	7	16.5	12	7	16.5
SANKOSTAR	SMHS	26	51.0 N	166.9 W	00	20	M 35	10 NM	03	0986.6	3.0	3.0	12	49	30	13	82.5
PRESIDENT PIERCE	WURV	26	52.5 N	176.2 E	06	14	50	2 NM	68	0996.7	2.8	1.1	3	23			
BELLMAN	9VUP	26	48.8 N	159.8 E	06	26	M 41	5 NM	22	0987.0	0.2	3.0	4	8	27	7	13
SUNWARD	ELZT	26	49.9 N	166.6 E	06	25	42	. 10 NM	58	0992.5	2.0	1.5	4	24.5	23	6	28
ALLTRANS EXPRESS	9VPU	26	38.1 N	161.3 W	18	27	M 45	2 NM	11	1000.0	8.0	12.6					
ZIM NEW YORK	DDPK	27	32.2 N	150.6 E	00	34	52	1 NM	60	1005.0	11.1	16.9	8	10			
GLOBAL FRONTIER	H3AU	27	29.9 N	162.4 E	06	35	M 46	2 NM	82	1000.3	13.5	18.0		6.5	32	10	14.5
PACIFIC SAGA	5MFK	27	29.0 N	164.6 E	12	31	48	5 NM	81	1006.0	13.0	18.0	5	10	31	8	11.5
TYSON LYKES	WSCJ	27	26.7 N	169.7 E	18	31	45	5 NM	25	0999.8	16.7	17.8	7	19.5			
CRYSTAL STAR	DSTG	27	47.9 N	148.9 W	18	09	M 45	5 NM	05	1018.5	8.0	6.0	6	16.5	09	6	19.5
BLUE OCEAN	JXQH	27	50.2 N	151.4 W	18	28	M 45	5 NM	01	1027.0	5.0	10.5	6	6.5	28	6	6.5
CRYSTAL STAR	DSTG	28	46.6 N	148.8 W	00	09	M 45	5 NM	05	1020.5	6.0	6.0	6	16.5	09	6	19.5
SEALAND PIONEER	WSVB	28	32.0 N	175.3 W	06	35	M 45	5 NM	03	0993.0	14.0	15.0		19.5	34	7	32.5
ALLTRANS EXPRESS	9VPU	28	38.5 N	142.9 W	18	10	M 47	10 NM	02	1015.5	14.0	14.5			10	6	5
SEATRAIN PRINCETON	DHPV	28	29.9 N	172.0 W	18	25	53	5 NM	25	0986.2	17.0	17.0	8	13	XX		19.5
SEATRAIN PRINCETON	DHPV	29	29.9 N	172.5 E	00	26	64	2 NM	25	0990.5	17.0	18.0	8	14.5	26	8	32.5
SEALAND PIONEER	WSVB	29	32.8 N	172.0 E	00	28	M 45	5 NM	25	1010.8	13.5	16.0		16.5	33	8	29.5
SEATRAIN CHESAPEAKE	DSOC	29	39.6 N	177.7 W	11	31	M 42	5 NM	02	0992.5	7.0	11.0	10	26	00		0
PHILADELPHIA	WJBO	30	58.2 N	148.0 W	00	36	50	2 NM	75	0998.3	2.2	6.1	3	13	36	< 6	19.5
YOUNG SPLENDOR	DSEF	30	49.8 N	168.4 W	06	02	M 45	2 NM	02	1000.0	4.5	4.5	7	14.5	06	8	16.5
OGDEN THAMES	6ZDA	30	32.0 N	143.9 E	12	29	M 42	5 NM	20	0999.0	18.0	20.0	6	13	XX		13
SEATRAIN ORISKANY	DSOM	30	39.5 N	157.3 W	12	24	M 45	5 NM	02	0975.2	11.8	11.0	6	16.5	00		0
PACIFIC VENTURE	HOVS	30	39.6 N	153.2 W	12	22	M 45	2 NM	02	0976.0	12.0	11.0	10	14.5	22	11	19.5

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves† Period sec.	Sea Waves† Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		JAN.															
PACIFIC ARROW	JGFM	30	34.2 N	163.9 W	18	25	M 45	2 NM	16	0994.5	12.0		2	5	28	9	14.5
SINCERE NO 3	ELRT	30	46.1 N	165.5 W	18	01	M 47	2 NM	02	0986.0	2.5	11.0	7	32.5	02	7	32.5
SEALAND LEADER	WSNH	30	48.9 N	137.3 W	18	16	M 44	2 NM	20	0999.2	7.5	8.0	8	8	16	8	10
HONSING ARROW	3ENE	30	44.4 N	161.8 W	21	02	M 45	2 NM	05	0978.0	4.5	8.0			02		36
PACDUCHESS	ABVI	31	46.7 N	156.2 W	00	05	M 46	.25 NM	02	0970.0	4.0	5.0	10	23	05	13	29.5
PACBARON	ABVI	31	51.1 N	135.2 W	00	16	M 45	.25 NM	55	0991.5	6.0	8.0	8	14.5	15	12	19.5
PORTLAND	WNDF	31	54.1 N	138.0 W	00	14	45	2 NM	63	0985.5	1.7	4.5	4	13	14	6	16.5
SINCERE NO 3	ELPT	31	44.8 N	165.1 W	00	01	M 47	10 NM	02	0986.0	2.5	11.0	7	32.5	02	7	32.5
PAN PACIFIC	D7SD	31	46.7 N	152.0 E	06	08	50	2 NM	47	0989.0	2.0	1.0					
BLUEBIRD	JJXL	31	49.2 N	165.8 W	06	02	M 42	5 NM	02	0993.5	1.5	6.0	2	5	01	8	13
PRESIDENT ADAMS	KAAV	31	50.2 N	132.0 W	06	15	50	2 NM	61	0995.9	7.2	7.2	6	16.5	15	8	24.5
GLACIER BAY	KACF	31	30.4 N	156.2 W	06	27	42	10 NM	01	1000.1	17.8	14.4	3	14.5	27	8	24.5
ALASKA	WFQE	31	58.2 N	144.7 W	06	09	62	5 NM	07	0980.3	2.2	5.5	10	16.5	12	7	36
SKAUGRAN	LHUK	31	45.7 N	154.2 E	06	11	45	1 NM	51	0991.0	2.0	3.0	12	24.5	12	>13	16.5
ALEUTIAN DEVELOPER	WIPL	31	56.1 N	158.1 W	12	32	M 45	10 NM	00	0988.1	- 6.5	3.3	5	8	32	7	14.5
B T SAN DIEGO	WSVR	31	59.1 N	145.0 W	12	08	M 47	5 NM	02	0978.0	2.2	3.3	9	21			
YOUNG SPLENDOR	DSEF	31	48.6 N	160.3 W	12	36	M 54	2 NM	02	0978.5	3.0	4.5	7	14.5	02	8	16.5
ALSTER EXPRESS	DIDL	31	47.9 N	156.9 E	12	09	52	2 NM	62	0998.9	2.5	1.0	13	29.5			
OGDEN THAMES	6ZDA	31	32.9 N	139.7 E	12	28	M 42	5 NM	02	1006.0	11.0	19.0	6	13	28	6	11.5
SPRUCE	JPOP	31	50.3 N	133.6 W	12	15	M 46	.5 NM	03	0993.5	7.5	7.0	7	5	33	7	14.5
PACIFIC ARROW	JGFM	31	35.0 N	156.2 W	12	25	M 43	2 NM	50	0992.0	13.0	13.3	2	5	28	10	16.5
PACIFIC VENTURE	HOVS	31	39.8 N	158.0 W	12	32	M 50	5 NM	02	0981.0	8.0	11.0	12	23	32	12	24.5
THOMPSON PASS	WSRY	31	59.8 N	145.7 W	18	07	60	2 NM	71	0998.1	- 1.0	5.5	3	16.5			
ENVIRONMENTAL BUOYS																	
46001		18	56.0 N	148.0 W	06	14	M 44			992.7	3.8	4.6	9	26			
46001		19	56.0 N	148.0 W	03	11	M 43			980.5	4.0	4.6	9	23			
46004		2	51.0 N	136.0 W	19	29	M 47			997.7	5.7	6.8					
46004		19	51.0 N	136.0 W	02	15	M 41			1016.4	5.5	5.6					
46004		30	51.0 N	136.0 W	21	15	M 42			994.5	6.1	5.4	8	14.5			
		FEB.															
ALASKA	WFQE	1	58.1 N	145.2 W	00	09	45	1 NM	20	0972.0	6.7	4.4	6	16.5	10	8	19.5
PACDUCHESS	ABVI	1	46.0 N	149.2 W	00	20	M 42	1 NM	02	0974.0	8.0	7.0	10	16.5	21	12	23
PAN PACIFIC	D7SD	1	44.3 N	148.2 E	00	23	45	10 NM	02	0990.0	2.0	1.0					
CHEVRON WASHINGTON	KFDB	1	48.2 N	125.0 W	00	17	M 45	5 NM	63	1008.2	4.4		4	8	17	6	10
MOBILE MERIDIAN	KGSM	1	59.9 N	145.6 W	06	09	M 41	5 NM	83	0973.8	4.4	4.4	6	14.5			
SEALAND PIONEER	WSVB	1	34.9 N	149.3 E	12	28	M 48	5 NM	25	1006.3	10.6	16.0	6	19.5	29	12	26
SKAUGRAN	LHUK	1	42.1 N	148.2 E	18	28	45	5 NM	26	1000.0	0.5						
AMERICAN AQUARIUS	WYBI	1	15.8 N	95.0 W	18	02	45	10 NM	00	1011.2	25.5	26.7	4	10	02	6	14.5
PACIFIC SAGA	5MFK	1	34.1 N	141.7 E	18	29	50	10 NM	01	1013.0	11.0	17.0	6	13	29	8	19.5
PACIFIC SAGA	5MFK	2	33.4 N	141.1 E	00	29	50	10 NM	03	1015.0	10.0	18.0	6	11.5	29	10	16.5
PACBARON	ABYI	2	54.0 N	152.6 W	00	33	M 43	1 NM	10	0969.0	1.0	5.0	7	11.5	34	10	14.5
ALSTER EXPRESS	DIDL	2	42.5 N	148.0 E	00	26	44	5 NM	85	0998.0	1.0	1.0	8	13	25	8	19.5
SKAUGRAN	LHUK	2	41.4 N	147.4 E	00	26	45	50 YD	26	1003.0	1.0	12.0	4	6.5	26	9	10
ALSTER EXPRESS	DIDL	2	41.2 N	147.2 E	06	25	52	2 NM	26	1000.0	1.0	1.0	8	16.5	27		16.5
PAN PACIFIC	D7SD	2	41.7 N	142.9 E	06	27	65	50 YD	84	1000.0	1.0	7.0					
SHUNWIND	ELIQ	2	34.0 N	143.1 E	12	27	M 44	10 NM	02	1013.5	12.5	18.0	6	10	27	8	13
SACRAMENTO	H3DR	2	45.7 N	132.4 W	12	17	M 50	5 NM	65	0993.0	7.0	7.0	5	10	19	9	10
CHEVRON CALIFORNIA	WCGN	2	58.6 N	151.2 W	12	10	45	10 NM	02	0971.0	4.4	2.2	2	11.5	10	< 6	14.5
CHEVRON COLORADO	KLHZ	2	44.2 N	125.3 W	18	18	M 45	5 NM	53	1010.2	10.0						
SEALAND PIONEER	WSVB	2	34.9 N	145.0 E	18	27	M 45	10 NM	02	1010.0	12.0	17.0	7	19.5			
PRINCE WILLIAM SOUND	WSDX	2	47.4 N	130.2 W	18	22	M 50	5 NM	01	0998.2	10.0	10.0	4	19.5			
PRESIDENT MADISON	WCIP	2	48.8 N	132.3 W	18	25	47	2 NM	01	0988.8	7.2	5.6	15	13			
ALEUTIAN DEVELOPER	WIPL	2	54.6 N	163.1 W	18	34	M 48	2 NM	45	0984.0	- 8.3	1.1	5	8	36	7	10
YOUNG SPLENDOR	DSEF	2	49.1 N	137.1 W	18	23	M 42	2 NM	02	0984.5	7.0	7.0	6	8	24	10	14.5
ATLANTIC PIONEER	H3WN	2	42.3 N	177.3 E	18	29	M 42	2 NM	02	0985.5	8.0	11.0	5	5	23	9	11.5
ATLANTIC PIONEER	H3WN	2	42.3 N	177.3 E	18	29	M 42	2 NM	02	0985.5	8.0	11.0	5	5	23	9	11.5
MOBILE MERIDIAN	KGSM	2	55.9 N	138.6 W	18	12	M 43	2 NM	82	0966.1	7.0	5.0	8	24.5	12	10	11.5
MOBILE MERIDIAN	KGSM	3	55.6 N	138.0 W	00	22	M 31	5 NM	60	0965.1	6.6	4.4	3	6.5	15	8	32.5
SILVERLIME	H3PF	3	40.3 N	145.9 E	00	29	M 48	1 NM	03	1006.0	4.0	9.0					
PACIFIC VENTURE	HOVS	3	39.3 N	178.7 W	00	29	M 59	2 NM	62	0990.8	6.0	13.0	12	29.5	29	12	29.5
PAN PACIFIC	D7SD	3	40.8 N	139.2 E	00	27	45	10 NM	02	1008.0	- 1.0	8.0					
PACBARON	ABYI	3	53.9 N	161.5 W	00	32	M 48	5 NM	01	0979.0	- 6.0	4.0	8	14.5	32	11	23
ALASKA	WFQE	3	54.0 N	138.4 W	00	24	45	10 NM	18	0977.0	6.2	4.4	6	23	24	8	26
PRINCE WILLIAM SOUND	WSDX	3	48.9 N	131.5 W	00	21	M 35	5 NM	03	1000.7	9.0	8.9			23	12	34.5
CHEVRON COLORADO	KLHZ	3	43.4 N	125.2 W	00	18	M 45	5 NM	50	1015.5	11.1		4	10	18	6	10
ATLANTIC PIONEER	H3WN	3	41.0 N	178.6 W	06	27	M 60	1 NM	12	0987.5	7.0	9.0	5	13	29	< 6	16.5
IRIS ISLAND	JPKG	3	45.5 N	179.3 E	06	09	M 47	1 NM	03	0993.0	5.0	8.0					
NEPTUNE DIAMOND	9VYT	3	39.5 N	171.4 W	12	29	M 43	5 NM	15	0988.5	7.0				29	< 6	10
SPRUCE	JPOP	3	54.2 N	160.0 W	18	31	M 50	1 NM	02	0981.5	- 7.5	3.5	11	19.5	13	6	18
MILLER FREEMAN	WTDM	3	57.4 N	172.6 W	18	02	M 46	2 NM	71	0994.2	-10.0	0.0			36	6	21
SPRUCE	JPOP	4	54.0 N	162.5 W	00	01	M 45	5 NM	02	0982.5	- 4.0	3.0	10	16.5	19	< 6	16.5
PAN PACIFIC	D7SD	4	38.1 N	134.5 E	00	25	50	10 NM	02	1013.0	3.0	10.0					
MOON RIVER	SLPN	4	41.3 N	148.9 W	06	16	M 45	2 NM	05	0992.0	12.0	9.0					
LIONS GATE BRIDGE	JCLL	4	46.0 N	164.7 W	09	02	M 43	2 NM	61	0976.5	1.5		3	11.5	04	7	13
SEATRAIN YORKTOWN	DSNP	4	32.8 N	155.7 W	18	22	M 62	2 NM	64	0996.3	15.5	18.0	7	19.5	27	8	26
PRESIDENT GRANT	WEZD	4	40.5 N	177.1 E	18	30	M 47	10 NM	02	0993.6	4.4	6.1	5	10	29	8	16.5
NANCY LYKES	WCUU	4	10.1 N	87.4 W	18	09	50	10 NM	01	1010.5	25.6	25.6	5	29.5	05	7	19.5
MALLORY LYKES	KLPN	4	15.4 N	95.5 W	18	07	44	10 NM	00	1013.9	26.1	26.1		8	07	< 6	11.5
CHEVRON CALIFORNIA	WCGN	5	49.1 N	136.1 W	00	13	45	2 NM	53	1005.8	8.9	4.4	3	11.5	13	< 6	16.5
SEALAND FINANCE	WJKG	5	51.0 N	144.5 W	00	14	45	1 NM	59	0993.0	7.2	5.5	8	13	14	10	19.5
SEATRAIN YORKTOWN	DSNP	5	32.8 N	155.9 W	00	27	M 55	5 NM	02	1003.5	15.5	18.0	10	19.5	27	>13	32.5
PRINCE WILLIAM SOUND	WSDX	5	59.1 N	144.3 W	06	11	M 42	2 NM	10	0999.8	6.2	5.6					
SACRAMENTO	H3DR	5	44.8 N	150.5 W	12	20	M 50	5 NM	03	0979.5	6.0	6.0	2	14.5	19	8	14.5
SPRUCE	JPOP	5	53.7 N	175.9 W	12	02	M 45	10 NM	03	0988.0	4.5	3.0	10	18	20	< 6	16.5
SEATRAIN YORKTOWN	DSNP	6	32.4 N	160.0 W	00	20	M 42	5 NM	02	1000.2	18.0	17.0	8	14.5	28		26
PRESIDENT WILSON	WNPD	6	36.7 N	147.0 E	00	28	50	5 NM	81	0999.0	7.3	17.8	5	13	28	8	13
CHARLES LYKES	KLHR	6	41.3 N	151.8 E	00	04	45	1 NM	75	0988.8	2.5	4.4	4	10	04	8	24.5
WORLD SUPREME	5LZF	6	38.8 N	151.8 E	00	25	M 41	2 NM	03	0987.5	8.0	3.0		8			
PACPRINCESS	5LVG	6	35.1 N	151.5 E	00	27	45	2 NM	60	0997.0	14.0	18.0	6	11.5	27	8	16.5
MOBILOIL	WMTD	6	58.7 N	143.7 W	04	09	M 70	2 NM	25	0988.8	4.5	5.0			10	< 6	19.5
PRESIDENT WILSON	WNPD	6	36.8 N	147.1 E	06	28	50	5 NM	02	1005.0	9.0	18.0	8	19.5	28	8	23
AMERICA SUN	WNEJ	6	45.2 N	129.6 W	06	25	M 50	5 NM	63	1000.6	.	8.9					
BUNGA MELAWIS	9MUT	6	39.5 N	154.0 E	06	34	M 45	5 NM	62	0981.0	5.0	11.0	5	24.5	30	6	16.5
VAN CONQUEROR	A8I8	6	35.4 N	147.2 E	12	31	M 43	1 NM	62	1011.0	4.0	19.0					
ARCO ANCHORAGE	WCIO	6	57.8 N	143.4 W	12	14	M 45	10 NM	02	0989.5	5.5	3.3	5	16.5	15	8	32.5
PACIFIC VENTURE	HOVS	6	34.6 N	158.4 E	12	29	M 74	.5 NM	68	0990.3	13.0	18.0	12	41	29	12	41
SHUNWIND	ELIQ	6	36.7 N	171.4 E	18	26	M 55	10 NM	02	0974.8	14.0	15.0	6	13	26	6	26
SEALAND COMMERCE	WEUJ	6	43.7 N	171.2 E	18	08	50	.25 NM	86	0958.3	1.1	4.4	10	19.5	09	12	23
STAR CARRIER	DSMC	6	37.8 N	173.5 E	23	25	M 60	1 NM	04	0972.0	13.0						

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves† Period sec.	Sea Waves† Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.*	Swell Waves Height ft.
NORTH PACIFIC OCEAN		FEB.															
GREAT OCEAN	JKJT	6	46.3 N	176.2 E	23	09	M 55	5 NM	03	0969.0	2.0	6.0	10	16.5	09	10	16.5
PACIFIC VENTURE	HOVS	7	33.8 N	157.1 E	00	29	M 54	1 NM	68	1002.3	13.0	16.0	12	28	29	12	28
MOBILOIL	WMTO	7	57.0 N	140.0 W	00	17	M 45	2 NM	02	0995.0	5.5	5.5	3	6.5	17	8	14.5
SHUNWIND	ELIQ	7	37.0 N	174.6 E	06	27	M 75	2 NM	07	0977.5	10.5	15.0	7	32.5	27	7	55.5
GREAT OCEAN	JKJT	7	46.8 N	177.3 E	11	10	M 57	1 NM	84	0953.0	2.0	5.0	10	16.5	09	10	19.5
VAN CONQUEROR	A8IB	7	35.5 N	154.6 E	12	30	M 45	2 NM	03	1003.0	7.0	17.0					
EASTERN TREASURE	6ZSP	7	36.8 N	173.7 W	18	25	M 48	5 NM	18	0979.5	8.0	11.0	XX	23	24	8	26
SINALOA	OXNS	7	49.5 N	175.4 W	18	07	M 58	200 YD	69	0959.0	2.0	6.0		23			
HOEGH MIRANDA	LIQZ	7	38.6 N	175.9 W	18	24	M 55	10 NM	90	0978.2	7.8		12	39			
STAR CARRIER	D5MC	7	37.6 N	179.9 W	21	26	M 60	1 NM	10	0987.0	9.0						
EASTERN TREASURE	6ZSP	8	39.0 N	172.8 W	00	26	M 48	2 NM	61	0982.5	8.0	11.0	XX	26	26	6	32.5
UNIVERSE KURE	6ZAE	8	38.3 N	160.4 W	00	18	M 41	2 NM	61	1001.0	13.0	11.5	6	11.5	20	8	13
HOEGH MIRANDA	LIQZ	8	38.6 N	174.4 W	00	25	M 45	5 NM	27	0984.0	11.0	10.3	5	8	25	8	23
PACIFIC VENTURE	HOVS	8	32.8 N	151.8 E	00	29	M 42	10 NM	03	1009.9	12.0	18.0	12	23	29	12	23
BREWSTER	H3NF	8	52.3 N	169.0 W	00	09	M 50	1 NM	26	0973.6	- 1.5	3.7	8	10	09	8	11.5
SACRAMENTO	H3DR	8	43.3 N	169.2 W	06	21	M 50	2 NM	21	0977.0	1.0	4.0	10	14.5	22	>13	16.5
SHUNWIND	ELIQ	8	36.8 N	179.3 W	06	27	M 15	10 NM	60	0988.0	8.0	13.0	4	6.5	30	8	42.5
RUSH WHEC 723	NLVS	8	56.7 N	173.1 W	12	04	M 46	2 NM	60	0975.0	- 3.2	3.9	3	3	05	< 6	11.5
MILLER FREEMAN	WTDM	8	56.4 N	172.6 W	12	07	M 43	1 NM	71	0969.2	2.2	3.6			07	8	24.5
SEALAND COMMERCE	WEUJ	8	48.4 N	162.1 W	18	17	35	5 NM	02	0982.0	5.6	2.8	8	16.5	16	>13	32.5
SINALOA	OXNS	8	50.6 N	167.2 W	23	18	M 43	1 NM	02	0966.0	5.7	6.2	8	24.5			
SHUNWIND	ELIQ	9	36.9 N	175.0 W	00	26	M 30	10 NM	60	0990.0	10.5	13.0	6	11.5	27	8	32.5
SEATRAIN YORKTOWN	D5NP	9	31.5 N	175.4 W	06	27	M 44	10 NM	80	0998.0	16.0	18.0	8	14.5			
PRESIDENT MADISON	WCIP	9	53.9 N	178.5 E	06	36	42	5 NM	70	0967.0	0.6	1.7	5	8			
EXXON PHILADELPHIA	WNFJ	9	60.0 N	146.1 W	18	12	45	2 NM	73	1014.9	3.5	7.7	5	6.5	09	10	16.5
PRESIDENT MADISON	WCIP	10	52.4 N	168.0 E	03	25	M 65	< 50 YD	75	0974.0	- 5.6	1.1	7	29.5			
EXXON PHILADELPHIA	WNFJ	10	59.3 N	145.3 W	06	09	45	5 NM	62	1011.9	5.6	7.3			09	10	16.5
MING CHEER	BLMG	10	39.0 N	170.0 W	06	27	M 42	10 NM	01		10.0	15.0	8	6.5			
BREWSTER	H3NF	10	54.1 N	152.7 W	12	07	M 45	2 NM	25	1000.0	4.0	5.0	5	5			
BREWSTER	H3NF	11	54.4 N	148.4 W	00	14	M 45	200 YD	45	0998.0	6.0	5.0	5	8	14	8	11.5
SACRAMENTO	H3DR	11	42.3 N	176.9 E	00	30	M 50	1 NM	44	0975.0	1.0	1.0	14	28	29	>13	26
PACPRINCESS	SLVG	11	37.9 N	177.5 W	00	25	42	2 NM	21	0986.0	15.0	14.0	7	11.5	25	8	19.5
PRESIDENT MADISON	WCIP	11	50.0 N	160.5 E	00	25	35	8 NM	70	0989.5	- 6.1	0.0	8	32.5			
UNIVERSE KURE	6ZAE	11	39.8 N	175.6 W	06	25	M 55	1 NM		0976.0	7.5	10.5	8	19.5	25	10	19.5
VAN CONQUEROR	A8IB	11	41.9 N	179.4 W	06	31	M 78	.25 NM	63	0971.0	5.0	10.0					
BUNGA MELAWIS	9MUT	11	45.7 N	171.2 W	12	09	M 42	2 NM	64	0976.0	1.5	6.0					
UNIVERSE KURE	6ZAE	12	39.8 N	177.6 W	00	30	M 48	10 NM	26	1001.0	6.0	11.5	7	23	29	12	24.5
WORLD SUPREME	SLZF	12	37.8 N	170.1 W	00	28	M 43	2 NM	02	0998.0	4.0	5.0			27		14.5
PACPRINCESS	SLVG	12	39.0 N	171.0 W	00	27	45	5 NM	23	0994.0	9.0	13.0	6	14.5	27	9	28
AMERICAN TRADER	WEZM	12	37.1 N	172.6 W	00	29	45	10 NM	80	1001.5	12.8	13.4	3	10	29	7	19.5
ALVA MAERSK	OZSD	12	32.5 N	139.2 W	06	34	50	5 NM	01	1000.0	15.0						
ALLTRANS EXPRESS	9VPU	12	51.4 N	167.6 E	12	26	M 48	10 NM	01	0995.0	- 1.0	3.8					
VAN CONQUEROR	A8IB	12	42.5 N	170.7 W	12	30	M 47	5 NM	27	0992.0	3.0	10.0					
ALLTRANS EXPRESS	9VPU	14	47.8 N	153.7 E	00	30	M 48	2 NM	75	1000.5	-10.0	2.8	3	1.5	29	7	6.5
CHESNUT HILL	WVFX	14	25.5 N	132.5 E	00	03	60	10 NM	03	1024.5	18.8	21.6	3	3	03	6	13
NEW GOLDEN PHOENIX	3EYN	14	44.4 N	160.2 W	06	12	M 42	5 NM	02	0997.0	7.0	9.0	6	10	13	7	11.5
PACIFIC VENTURE	HOVS	14	35.5 N	165.3 E	06	28	M 50	2 NM	01	1002.4	10.0	16.0	12	24.5	28	12	26
ARCTIC TOKYO	SLJT	14	47.4 N	150.4 E	12	26	M 60	5 NM	26	1000.0	- 7.0	- 1.0	6	6.5			
UNIVERSE KURE	6ZAE	14	39.3 N	166.7 E	12	18	M 42	5 NM	01	1001.0	5.5	12.0	5	10	30	7	11.5
BLUE OCEAN	JKGH	14	48.9 N	164.4 E	18	23	M 45	< 50 YD	02	0993.0	- 4.0	6.0	7	10	23	7	10
BLUE OCEAN	JKGH	15	48.7 N	163.8 E	00	22	M 50	5 NM	02	0992.0	- 4.0	6.0	5	8	22	7	10
PACIFIC ACE	H3YP	15	34.3 N	144.8 E	00	26	M 42	5 NM	03	1017.0	11.5	20.0	5	10	27	< 6	10
WESER EXPRESS	DLDE	15	50.6 N	163.9 E	00	14	56	50 YD	86	0989.2	- 3.5	0.5	8	16.5	20		10
ORIENTAL EXECUTIVE	D5AN	15	31.9 N	170.9 W	06	25	M 63	2 NM	64	0997.0	15.0						
ARCTIC TOKYO	SLJT	15	44.5 N	153.0 E	06	26	M 45	10 NM	26	1001.0	- 6.0	- 1.0	5	5			
YAMASHIN MARU	JBES	15	51.1 N	149.1 W	12	27	M 42	2 NM	74	0984.6	- 3.0	5.0	5	11.5	30	8	14.5
PACIFIC ARROW	JGFM	15	31.9 N	169.0 W	18	28	M 50	5 NM	03	0993.0	13.5				28	9	16.5
PAN PACIFIC	D7SD	15	39.6 N	161.5 E	18	09	53	.25 NM	20	1006.0	3.0	11.0					
AMERICAN LANCER	WZJB	15	29.8 N	142.1 W	18	23	55	5 NM	82	0989.0	15.6	17.2	8	13	26	9	10
ALLTRANS EXPRESS	9VPU	15	41.3 N	140.2 E	18	30	M 55	5 NM	26	1013.5	- 4.5	10.2					
SOUTH EXPRESS	A8WR	15	36.6 N	177.6 W	18	32	M 45	5 NM	63	1003.5	8.0	13.0	8	13	32		13
SEALAND ADVENTURER	KSLJ	15	29.4 N	150.0 W	18	28	M 48	5 NM	02	0992.5	15.5	17.0	4	10	28	9	24.5
SEALAND ADVENTURER	KSLJ	16	29.4 N	148.5 W	00	28	M 43	10 NM	02	0995.5	20.5	18.0	6	3	28	11	23
ALVA MAERSK	OZSD	16	33.5 N	172.4 W	00	30	55	5 NM	01	0996.2	14.0		XX	26			
DITTE SKOU	OWJG	16	29.9 N	149.2 W	00	27	50	5 NM	02	0997.5	17.2			32.5			
PACIFIC ARROW	JGFM	16	31.8 N	170.2 W	00	29	M 53	2 NM	07	0996.0	13.0				29	9	18
PACIFIC PEACE	H3VX	16	40.0 N	160.4 E	00	14	M 55	< 50 YD	89	0997.0	4.0	9.0	12	19.5	34	10	24.5
PAN PACIFIC	D7SD	16	40.8 N	164.3 E	06	09	60	.25 NM	02	0995.0	3.0	8.0					
SOUTH EXPRESS	A8WR	16	37.0 N	174.5 W	06	32	M 45	2 NM	63	1004.5	10.0	14.0	8	13	32	6	13
ORIENTAL EXECUTIVE	D5AN	16	30.3 N	176.7 W	06	30	M 59	10 NM	03	1014.0	17.0						
ALLTRANS EXPRESS	9VPU	16	39.5 N	137.3 E	06	30	M 50	2 NM	86	1023.5	- 4.5	8.0					
SEATRAIN VALLEY FORGE	9VPV	16	34.7 N	168.7 W	06	31	M 43	2 NM	18	0994.5	13.0	14.0	5	10	31	9	24.5
AMERICAN LANCER	WZJB	16	28.4 N	143.8 W	06	26	45	5 NM	82	1000.3	17.8	20.6	15	24.5			
MAUI	WSLH	16	29.8 N	135.6 W	12	23	72	2 NM	25	0995.5	18.3	18.9	7	24.5	26	8	29.5
VENZUELA MARU	JIXX	17	30.9 N	157.2 W	00	28	M 43	5 NM	81	0994.0	16.0	17.5	7	11.5	28	>13	26
TOYOTA MARU 10	JKBI	17	27.6 N	156.0 W	06	28	M 44	5 NM	01	1004.8	17.7	18.0	8	16.5	29	10	19.5
SEATRAIN VALLEY FORGE	9VPV	17	32.5 N	173.2 W	06	25	M 45	5 NM	25	1009.5	15.5	14.0	5	10	25	9	26
MAUI	WSLH	17	26.9 N	141.4 W	12	27	55	2 NM	81	1001.0	17.2	20.0	5	11.5	26	7	14.5
MAUNAWILI	WNKP	17	29.5 N	149.1 W	18	30	42	10 NM	02	1001.0	16.1	17.0	8	26	27	>13	36
SIENA	OXFU	17	33.6 N	163.0 W	18	31	M 42	10 NM	02	1006.2	11.3	13.0	6	13	27	13	26
MAUNALEI	KSVE	17	30.3 N	142.1 W	18	25	60	2 NM	81	0997.0	15.6	19.7	4	8	25		32.5
CHEVRON COLORADO	KLHZ	17	39.0 N	124.3 W	18	15	M 42	2 NM	02	0997.4	11.2						
MANUKAI	KHLO	18	33.4 N	135.6 W	00	25	45	10 NM	02	0992.0	15.6	17.8	4	6.5	25	< 6	13
MAUNAWILI	WNKP	18	28.7 N	149.4 W	00	27	45	10 NM	02	1005.0	18.3	18.3	4	10	27	7	29.5
ORIENTAL ESEARCHER	ZCKD	18	37.3 N	167.1 E	02	30	M 44	10 NM	01	1004.0	3.0	15.0	2	1.5	29	< 6	8
SEATRAIN TRENTON	9VAJ	18	33.5 N	137.8 W	06	26	M 41	10 NM	01	0996.1	15.0	17.0					
DITTE SKOU	OWJG	18	28.8 N	143.8 W	06	27	47	.5 NM	92	1008.0	19.0	18.0	XX	19.5	27	11	23
VENZUELA MARU	JIXX	18	30.8 N	148.4 W	06	29	M 45	5 NM	25	1003.5	13.5	18.5	7	11.5	28	>13	21
MAUNALEI	KSVE	18	28.0 N	143.8 W	18	29	45	5 NM	01	1012.1	17.8	20.0	11	39	26		19.5
CHESNUT HILL	WVFX	19	35.7 N	167.7 E	00	26	40	5 NM	16	1002.0	8.3	16.1	10	16.5	26	9	32.5
PACMERCHANT	SMCB	19	35.7 N	168.5 E	00	28	M 45	5 NM	03	1001.0	10.0	17.0	4	8	28	13	14.5
SEATRAIN INDEPENDENCE	D5KL	19	38.2 N	178.0 E	00	27	45	5 NM	93	1006.5	9.8	11.0	5	13	27	7	19.5
SEATRAIN YORKTOWN	D5NP	19	34.7 N	150.9 E	18	20	M 48	2 NM	62	0996.0	14.0	16.0					
ORIENTAL EXECUTIVE	D5AN	19	31.9 N	153.3 E	21	23	M 46	5 NM	58	1007.0	17.0						

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves+ Period sec.	Sea Waves+ Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		FEB.															
PACMERCHANT	SMCB	20	36.4 N	175.6 E	00	27	M 45	5 NM	82	1004.5	8.0	17.0	4	6.5	27	13	14.5
SANKOSTAR	5MHS	20	34.0 N	156.1 E	00	24	M 47	2 NM	02	1000.0	16.5	18.0	25	11.5	24	< 6	11.5
EASTERN HORNET	6ZDD	20	33.2 N	156.7 E	00	21	M 55	2 NM	18	1009.0	15.0	16.0	10	41			
PACIFIC VENTURE	HOVS	20	35.4 N	140.4 W	12	28	M 42	2 NM	52	1002.0	15.0	16.0	12	21	28	12	24.5
CHESNUT HILL	WVFX	21	37.0 N	177.1 W	00	22	40	5 NM	16	0984.0	14.4	13.3	8	13	22	9	36
ROYAL VIKING STAR	LILY	21	33.3 N	131.4 W	00	26	45	5 NM	91	1007.5	19.5	18.0	8	24.5			
PACIFIC ACE	H3YP	21	34.3 N	171.1 W	06	23	M 45	2 NM	51	0995.5	15.0	16.0	5	10	23	7	11.5
HARUNA MARU	JJKQ	22	38.4 N	174.6 W	00	29	M 44	10 NM	23	0994.0	9.0	12.0	2	5	29	6	11.5
PAN PACIFIC	D7SD	22	49.8 N	148.2 W	12	11	60	2 NM	62	0977.0	4.0	5.0					
ALSTER EXPRESS	DIDL	22	37.7 N	164.5 E	18	29	44	5 NM	81	0995.5	7.0	12.0	7	13			
AMERICAN LARK	WZJF	23	34.3 N	163.8 E	00	29	M 41	10 NM	02	1006.0	10.0	14.0	9	18	31	11	18
PAN PACIFIC	D7SD	23	50.0 N	145.3 W	00	14	47	5 NM	02	0976.0	10.0	5.0					
SOHIO INTREPID	KACK	23	59.5 N	145.5 W	12	11	45	5 NM	52	0994.1	5.6	5.6	3	8	12	8	19.5
SOHIO INTREPID	KACK	24	58.5 N	144.2 W	00	14	45	5 NM	07	0999.3	6.1	6.7	3	8	14	9	18
MOBILE MERIDIAN	K6SM	24	50.5 N	129.5 W	00	13	M 41	10 NM	02	1013.5	8.9	7.7	5	14.5	18	8	6.5
DAFFODIL	H3AG	24	43.6 N	173.9 W	00	05	M 48	< 50 YD	57	0978.0	8.0	5.0	1	11.5	05	< 6	11.5
CALIFORNIAN	KPZK	24	31.9 N	147.1 W	00	25	45	10 NM	02	1007.5	15.6	17.2	3	10	27	6	16.5
AMERICAN ASTRONAUT	WZJG	24	39.8 N	144.7 W	06	10	42	2 NM	63	0985.0	11.1	12.2					
BUNGA MELAWIS	9MUT	24	47.7 N	128.4 W	06	14	M 45	2 NM	63	1005.5	8.0	8.0					
HARUNA MARU	JJKQ	24	38.3 N	145.8 W	18	25	M 46	5 NM	03	0990.0	10.5	13.0	3	5	23	7	13
AMERICAN ASTRONAUT	WZJG	25	39.4 N	136.6 W	00	23	42	5 NM	02	0998.2	14.4	13.3	10	10	23	10	11.5
PRESIDENT PIERCE	WURV	25	43.6 N	151.3 E	06	30	45	2 NM	26	1003.7	3.3	1.2	6	8	30	7	11.5
PAN PACIFIC	D7SD	25	49.1 N	128.6 W	06	16	48	10 NM	02	1012.0	10.0	7.0					
ATLANTIC PIONEER	H3WN	25	49.8 N	174.5 W	18	14	M 50	< 50 YD	64	0992.0	1.5	20.0					
SEAWAY EXPRESS	DDFO	25	52.1 N	173.4 E	21	14	41	.5 NM	70	0991.3	2.4	3.0		24.5			
SEAWAY EXPRESS	DDFO	26	51.9 N	172.2 E	00	12	47	.5 NM	10	0982.8	2.5	3.0		28			
SANKOSTAR	5MHS	26	35.9 N	161.3 W	00	28	M 46	5 NM	01	0999.0	13.0	14.0	5	16.5	29	>13	26
SUCCESSFUL VENTURE	5LKJ	26	42.4 N	178.7 W	00	15	M 43	5 NM	02	0998.0	7.5	10.0	6	16.5	15	9	16.5
PRESIDENT POLK	WNEI	26	38.5 N	178.5 E	00	14	45	2 NM	62	0985.5	10.7	11.7	3	8	15	< 6	11.5
VAN WARRIOR	5MEV	26	42.6 N	179.9 W	06	13	75	1 NM	08	0975.0	8.0	6.0	5	14.5	16	8	24.5
IRIS ISLAND	JPKG	26	54.1 N	172.5 E	06	13	M 50	1 NM	22	0988.0	- 3.0	2.0	2	3	13	< 6	13
OVERSEAS JUNEAU	WWND	26	13.8 N	95.3 W	12	10	45	5 NM	03	1013.0	23.8	25.6	8	29.5	24	>13	16.5
SEAWAY DISPATCH	DDFY	26	40.7 N	137.6 W	12	18	43	10 NM	01	0996.0	12.0	13.0	8	19.5	18	9	21
EASTERN RIVER	D5ES	26	37.2 N	159.0 W	12	27	M 45	2 NM	02	1008.0	10.5	9.0			24	< 6	16.5
JAPAN CAOBO	5MKV	26	29.9 N	135.6 W	18	22	35	10 NM	03	1007.5	21.0	19.0	6	10	22	8	32.5
CHESNUT HILL	WVFX	26	48.3 N	130.5 W	18	17	35	5 NM	07	0993.0	10.0	7.2	6	10	18		36
PRESIDENT MADISON	WCIP	26	47.9 N	179.8 W	18	14	50	1 NM	54	0962.2	4.5	2.8	14	16.5			
JAPAN ACE	JKFS	26	33.7 N	154.4 W	18	30	M 46	5 NM	25	1011.0	12.0	15.0	XX	14.5	32		16.5
EASTERN PACIFIC	JLVS	27	48.8 N	176.3 E	00	30	M 49	.5 NM	07	0976.5	2.0	2.0	XX	13	12	10	14.5
PACIFIC VENTURE	HOVS	27	47.9 N	130.5 W	00	18	M 42	5 NM	02	0996.8	12.0	9.0	12	23	18	12	24.5
PRESIDENT MADISON	WCIP	27	48.7 N	178.3 W	00	18	50	2 NM	10	0979.1	2.8	2.8	9	24.5			
SEATRAIN CHESAPEAKE	D5QC	27	47.4 N	178.9 W	05	24	M 44	2 NM	20	0998.5	2.0	3.0	12	16.5	25	13	16.5
ERRADALE	ZCKV	27	46.4 N	179.0 E	06	27	M 45	10 NM	15	0991.1	3.0	5.0	4	11.5	30	9	29.5
EASTERN RIVER	D5ES	27	36.6 N	165.2 W	18	27	M 50	2 NM	81	0994.0	10.0	9.0	5	10	28	10	10
EASTERN RIVER	D5ES	28	36.3 N	166.4 W	00	28	M 50	5 NM	01	1006.0	12.0	9.0	6	10	XX		13
SUCCESSFUL VENTURE	5LKJ	28	44.1 N	165.1 W	00	31	M 43	5 NM	18	0992.0	4.2	8.0	8	26	15	8	16.5
SPRUCE	JPQP	28	39.1 N	167.7 E	00	27	M 50	5 NM	01	0996.5	8.9	12.0	14	19.5	09	10	24.5
SEATRAIN CHESAPEAKE	D5QC	28	45.7 N	174.5 E	05	12	M 42	.5 NM	42	0996.8	6.0	2.0	12	16.5	19	8	8
QUEENS WAY BRIDGE	JHJE	28	39.0 N	150.9 W	06	14	M 42	2 NM	65	0993.5	11.0		5	10	13	7	10
SEAWAY EXPRESS	DDFO	28	46.1 N	155.1 E	09	29	31	10 NM	02	0991.0	- 1.0	15.0		18	27		32.5
MOBIL ARCTIC	KSPY	28	46.8 N	131.5 W	12	23	M 45	5 NM	60	0995.5	6.7	7.3	4	14.5	19	7	14.5
ARCO ANCHORAGE	WCIO	28	49.0 N	129.0 W	18	18	45	5 NM	62	0998.0	7.0	4.6	4	10	19	9	18
ASIA HONESTY	ABLL	29	52.2 N	174.2 E	00	07	M 43	5 NM	03	0972.0	5.0	4.0	20	10	07	< 6	11.5
SEALAND MCLEAN	WHGA	29	46.0 N	156.8 E	18	32	45	5 NM	02	0994.1	- 2.8	0.0	9	16.5	32	9	21
EXXON NEW ORLEANS	WNDM	29	44.6 N	127.4 W	18	15	M 45	5 NM	02	1016.1	15.0	9.4	3	5	18	6	10
ENVIRONMENTAL BUOYS																	
46004		2	51.0 N	136.0 W	18	25	M 44			973.1	4.8	5.4	8	14.5			
46004		5	51.0 N	136.0 W	06	12	M 43			1003.6	5.9	5.3	7	13			
46005		6	46.0 N	131.0 W	06	27	M 42			1005.8	8.9	8.8	6	10			

+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

U.S. Cooperative Ship Weather Reports

January and February 1980

This listing includes only those ships recruited in the U.S. Cooperative Ship Program whose Ship's Weather Observations (NOAA Form 72-1) were mailed to the National Climatic Center and/or the coded weather observations were transmitted to the appropriate radio station.

SHIP NAME	VIA RADIO	VIA MAIL
OGDEN THAMES	40	131
ACUSHNET WAGO 167		99
AIMEE LYKES	23	64
ALBERT MAERSK	22	68
ALLTRANS EXPRESS	46	125
AMELIA TOPIC	7	
AMERICAN ACE		126
AMERICAN ARCHER	44	97
AMERICAN CHALLENGER	13	90
AMERICAN CORSAIR	28	30
AMERICAN LANCER	34	143
AMERICAN LEGEND	26	58
AMERICAN RACER	16	58
AMERICANA	15	41
AMOCO SINGAPORE	1	
ANDERS MAERSK	20	29
ANTONIA JOHNSON	5	18
ARCO FAIRBANKS	81	102
ARCO PRUDHOE BAY	79	97
ARIES	18	
ARTHUR MIDDLETON	8	38
ASIA BRAVERY	15	86
ASIA HONG	24	
ATHEL LAADKI	19	
AUSTRAL ENTENTE	74	66
AUSTRAL MOON	69	54
AUSTRAL PIONEER	31	89
AZTECA	10	6
BARBER PRIAM	45	80
BARRANCA	74	
BAYAMON		42
BERGLJOT	15	
BLUEBIRD	70	63
BORINQUEN	32	91
BRIGHT HOPE	29	18
C V STAGHOUND	18	79
CAMARA	49	68
CHALMETTE	39	
CHARLESTON	28	59
CHAUVENET T AGS 29		181
CHESNUT HILL	59	71
CHEVRON BURNABY	1	79
CHEVRON EDINBURGH	25	147
CHEVRON LOUISIANA	14	13
CHEVRON PERNIS	24	70
CHEVRON WASHINGTON	41	78
CITRUS WLB300	3	
CLOVER WLB 392	15	
COLUMBUS AUSTRALIA	13	30
COMANCHE WMEC 202	1	
CORANTIJN	4	23
COURAGEOUS WMEC 622		32
CRYSTAL REED	14	
DAUNTLESS CG		23
DAVID STARR JORDAN	94	146
DEL SOL	13	46
DELTA AFRICA	1	48
DELTA MAR	29	87
DELTA VENEZUELA	12	53
DITTE SKOU	27	100
DOLLY TURMAN	28	4
DRUCILLA U	19	45
E J MCCLANAHAN	1	
EASTERN JADE	16	
EASTERN TREASURE	25	53
EDELWEISS	8	
EL PASO ARZEW	121	135
EL PASO SOUTHERN	23	34
ERRADALE	1	
ESSO PALM BEACH	4	
EVELINE	6	
EXPORT BANNER	18	12
EXPORT CHAMPION	17	117
EXPORT LEADER	26	
EXXON BATON ROUGE	15	24
EXXON HUNTINGTON	37	54
EXXON NORTH SLOPE	13	35
FAIRWEATHER	1	
FLEETBANK	51	
FRIENDSHIP	32	110
GARDENIA	47	58
GENEVIEVE LYKES	24	10
GEORGE WALTON	20	101
GLADIOLUS	8	
GOLDEN BEAR	63	135
GOLDEN GATE BRIDGE	62	59
GRAND GLOBE	25	
GREEN AUKLET	45	
GUADALUPE	6	
GULF TRADER	10	25
HANJIN INCHEON	6	31
HAWAIIAN CITIZEN	35	62
HIEI MARU	104	41
HOEGH MASCOT	1	26
HOEGH PILOT	9	
HONSHU GLORIA	55	66
HOWELL LYKES	17	103
INGER	4	110
IRIS WLB395	1	
JACKSONVILLE	30	105
JAMES E O'BRIEN	53	126
JAPAN BEAR	58	107
JELA TOPIC	9	77
JOSEPH LYKES	8	102
KEIYO	19	88
KOREAN COMMANDER	6	17
KOREAN PRIDE		6
KUROBE MARU	40	18
LAKE ARROWHEAD	2	11
LASH ITALIA	12	27
LESLIE LYKES	26	45
LILLOOET	14	71
LOUISE	52	121
MAGDALENA	95	
MAMMOTH PINE		1
MANISTEE	20	
MANULEI	86	90
MARCONA EXPORTER	36	204
MARGARET LYKES	3	60
MARINE CHEMICAL TRANSP	34	66
MASON LYKES	16	52
MAUMEE	16	71
MAYO LYKES	28	38
ACADIA	18	40
ADM WM M CALLAGHAN	36	76
ALASKA STANDARD	23	33
ALEUTIAN DEVELOPER	20	32
ALMERIA LYKES	29	57
AMERICA MARU	101	42
AMERICAN ALLIANCE	29	74
AMERICAN ARGOSY	48	97
AMERICAN CHAMPION	121	139
AMERICAN COURIER	15	87
AMERICAN LARK	25	108
AMERICAN LEGION	20	130
AMERICAN RANGER	22	69
AMOCO CAIRO		231
ANCHORAGE	47	109
ANNA MAERSK	23	83
ARAS	1	
ARCO HERITAGE		26
ARCTIC TOKYO		174
ARILD MAERSK	27	82
ASHLEY LYKES	7	37
ASIA HERON	17	
ASIA MORALITY	8	
ATLANTIC PIONEER	22	118
AUSTRAL ENVOY	15	62
AUSTRAL PATRIOT	4	32
AUSTRAL RAINBOW	105	124
B T SAN DIEGO	11	101
BARBER TAIF	19	26
BARTLETT AGOR 13	9	
BAYANO	46	
BERNES	56	
BOGASARI SATU	4	
BOSTON	6	
BRINTON LYKES	23	59
CAGUAS		10
CAPRICORN	35	58
CHANCELLORSVILLE		46
CHARLOTTE LYKES	11	
CHAVEZ	39	141
CHEVRON ANTWERP	2	138
CHEVRON CALIFORNIA	78	116
CHEVRON FELUY	47	177
CHEVRON MISSISSIPPI	33	89
CHEVRON PERTH	28	63
CHI CHING	18	
CITY OF DUNDEE	1	
COLORADO	16	42
COLUMBUS LOUISANA	16	56
COMET	19	41
CORINTO MARU	30	40
COVADONGA	33	58
DAFFODIL	28	146
DAVID D. IRWIN	30	37
DEFIANCE	39	106
DELAWARE GETTY	41	67
DELTA AMERICA	5	
DELTA MEXICO	10	16
DIAMOND PHOENIX	41	
DJATISARI	26	
DON CARLOS	23	49
DUANE	7	
EAGLE CHARGER	9	
EASTERN MUSE	47	
EASTERN WISEMAN	19	
EDGAR M QUEENY	39	23
EL PASO CONSOLIDATED	6	
ELIZABETH LYKES	29	31
ESSO ALBANY	3	
ESSO PROVIDENCE	27	64
EVER SPRING	26	42
EXPORT BUILDER	16	22
EXPORT COMMERCE	5	
EXPORT PATRIOT	12	67
EXXON BOSTON	26	56
EXXON JAMESTOWN	5	5
EXXON PHILADELPHIA	30	81
FALSTRIA	54	99
FORT HIPP	1	
FRUCO	2	
GARTHNEWYDD	6	62
GENISTA	7	21
GIBRALTAR MARU	16	30
GLOBAL FRONTIER	32	99
GOLDEN DAISY	21	
GOLDEN RAY	8	
GREAT CONCERT	1	
GREEN HARBOUR	9	56
GULF BANKER	11	62
GUNDA BROVIG	2	
HARDANGER	17	26
HELLESPONT GLORY	12	10
HILLYER BROWN	28	21
HOEGH MERCHANT	9	
HOEGH PRIDE	11	31
HOTAKA MARU	114	59
HUDSON T-AO 184	22	
INGHAM WHEC 35		46
IRONWOOD WLB 297	6	
JADRAN	14	
JAMES LYKES	31	38
JAPAN CAODO	1	51
JOHN B WATERMAN	8	
JUTHLANDIA	49	128
KEYSTONER	34	89
KOREAN FIR	6	33
KOW OK	3	
L.W. FUNKHOUSER	17	113
LAKE PALOURDE	7	148
LASH PACIFICO	18	73
LETITIA LYKES	19	53
LIONS GATE BRIDGE	118	123
LOUISE LYKES	23	51
MALLORY LYKES	28	81
MANHATTAN	10	34
MANUAWILI	66	113
MANZANARES	23	
MARCONA TRADER	35	
MARIA RUBICON	3	
MARITIME CHALLENGE	6	
MATHIESON	22	
MAYA PIONEER		48
MEADOWBROOK	2	25
ACE ENTERPRISE	18	53
ADRIAN MAERSK	43	131
ALASKAN	74	108
ALLISON LYKES	18	
ALSTER EXPRESS	15	118
AMERICA SUN	29	72
AMERICAN APOLLO	15	165
AMERICAN ARROW	16	
AMERICAN CHARGER	14	73
AMERICAN EXPLORER	33	93
AMERICAN LEADER	4	39
AMERICAN LIBERTY	68	126
AMERICAN RELIANCE	14	51
AMOCO CHALLENGER	27	
ANCO STANE	108	
ANNIE JOHNSON	15	78
ARCO ANCHORAGE	65	81
ARCO JUNEAU	84	41
ARECIBO	29	119
ARNOLD MAERSK	25	37
ASIA BEAUTY	51	79
ASIA HONESTY	16	89
ASIA ZEBRA	7	
AUSTRAL ENDURANCE	13	62
AUSTRAL GLEN	1	
AUSTRAL PILGRIM	2	
AVILA	18	39
BALD BUTTE	11	106
BARBER TOBA	24	25
BASSWOOD WLB386	1	
BEISHU MARU	33	23
BIBB WHEC 31	41	
BOHEME	17	43
BRAZOS	20	62
BUTTONWOOD WLB 306	89	
CALIFORNIA RAINBOW	13	17
CARNIVALE	47	47
CHARLES LYKES	25	92
CHASE WHEC 718	6	
CHEROKEE WMEC 165	1	27
CHEVRON ARIZONA	54	85
CHEVRON COLORADO	47	73
CHEVRON KENTUCKY	149	
CHEVRON NORTH AMERICA		155
CHEVRON ROME	37	
CHIKO	11	
CIUDAD DE NEIVA	2	
COLUMBIA	22	
COLUMBUS NEW ZEALAND	19	103
CONALCO	6	
CORNUCOPIA	28	103
CRESSIDA	37	112
DALAMAN	21	48
DAVID P REYNOLDS	88	146
DEL ORO		16
DELAWARE II	10	67
DELTA ARGENTINA	33	29
DELTA PARAGUAY	6	33
DIANA PROSPERITY	32	69
DOCEANGRA	1	
DONA CORAZON II		116
DYVI KATTEGAT	17	29
EASTERN DIAMOND	3	94
EASTERN PACIFIC	14	19
EASTERN WORLD	21	
EIDANGER	3	
EL PASO HOWARD BOYD	3	
ENNA G	35	144
ESSO BAYONNE		53
ESSO SAINT JOHN	14	19
EVER SUMMIT		28
EXPORT BUYER	5	
EXPORT COURIER	3	
EXXON BALTIMORE	16	22
EXXON FLORENCE	11	13
EXXON LEXINGTON	7	24
EXXON SAN FRANCISCO	18	36
FERNGROVE	1	
FRANCIS SINCERE NO 6	43	62
GAGE LUND	77	
GEDIZ	1	
GEORGE B KELEZ	27	
GLACIER WAGB 4	70	78
GLOMAR CHALLENGER	63	202
GOLDEN EXPLORER	1	
GRAND CARRIER	13	36
GREAT LAND	51	65
GREEN ISLAND	5	26
GULF FARMER	14	61
GUNTHER SCHULTE	2	
HARNGJIN	9	
HERON	18	
HOEGH MALLARD		34
HOEGH MERIT	6	37
HONSING ARROW		15
HOUSTON	1	47
IMPERIAL	3	7
IRIS ISLAND	32	158
J LOUIS	55	69
JALATAMINI	7	
JAPAN ACE	70	33
JAPAN RAINBOW	1	1
JOHN LYKES	30	
K H CRANDALL		46
KOFUKU MARU	22	111
KOREAN JUPITER	7	32
KRPAN	82	
LABRADOR CLIPPER	18	
LAKE SHASTA	16	112
LEDA MAERSK	34	51
LEXA MAERSK	43	
LIPSCOMB LYKES	56	131
LUIGI GRIMALDI	20	
MALLOW WLB 396	6	
MANHATTAN DUKE		45
MANUKAI	90	139
MAR DE CORTEZ	37	114
MARCONA TRANSPORTER	16	76
MARIA TOPIC	15	42
MARITIME HARMONY	2	
MATSONIA	56	101
MAYAGUEZ	73	148
MELVIN H. BAKER	65	
ACONCAGUA	6	
AGUADILLA	63	98
ALBATROSS IV	51	
ALLTRANS ENTERPRISE	32	75
ALVA MAERSK	29	93
AMERICAN ACCORD	55	105
AMERICAN AQUARIUS	53	134
AMERICAN ASTRONAUT	41	129
AMERICAN CHIEFTAIN	25	88
AMERICAN HERITAGE	23	48
AMERICAN LEGACY	45	114
AMERICAN LYNX	22	118
AMERICAN TRADER	54	203
AMOCO MILFORD HAVEN	9	32
ANCO TEMPLAR	65	
ANTE TOPIC		43
ARCO ENTERPRISE	10	40
ARCO PRESTIGE	59	74
ARGONAUT	35	75
ARTHUR MAERSK	36	62
ASIA BOTAN	19	97
ASIA INDUSTRY	6	
ASIAN ASSURANCE	4	102
AUSTRAL ENSIGN	12	27
AUSTRAL LIGHTNING	59	135
AUSTRAL PILOT	32	78
AXEL MAERSK	5	64
BALTIMORE TRADER	10	103
BARBER TONSBERG	18	
BAUMARE	1	
BELLMAN	37	66
BLUE OCEAN	6	110
BOLNES	2	
BREWSTER	61	142
C V LIGHTNING	27	73
CALIFORNIAN	42	75
CELESTINO	2	
CHARLES PIGOTT	26	87
CHASTINE MAERSK	17	51
CHERRY VALLEY	10	17
CHEVRON BRUSSELS		159
CHEVRON COPENHAGEN	4	118
CHEVRON LONDON		106
CHEVRON OREGON	8	3
CHEVRON SOUTH AMERICA		118
CHRISTOPHER LYKES	32	78
CK APOLLO	8	17
COLUMBUS AMERICA	12	107
COLUMBUS VICTORIA	68	142
CONFIDENCE WMEC 619		23
CORONADO	41	113
CRISTOBAL	6	84
DALLAS WHEC 716	7	
DAVID PACKARD		62
DEL RIO	5	
DELAWARE SUN	40	68
DELTA ECUADOR	13	78
DELTA PERU	8	
DISCOVERER OSS	66	88
DOCTOR LYKES	94	127
DORIC	3	30
DYVI PACIFIC	6	
EASTERN FORTUNE	17	
EASTERN RIVER	12	27
EATON GLORIA	1	
EL MEXICANO	6	
EL PASO SONATRACH	31	87
ERNA OLDENDORFF	24	
ESSO CASTELLON	2	
EURO-ASIA CONCORDE	22	64
EVERGREEN WAGO-295	75	88
EXPORT CHALLENGER	11	36
EXPORT FREEDOM	30	76
EXXON BANGOR	14	40
EXXON HOUSTON	18	24
EXXON NEW ORLEANS	2	5
EXXON WASHINGTON	16	27
FESTIVALE	14	30
FREDERICK LYKES	29	65
GALLEON JADE	9	
GENE TREFETHEN	7	
GEORGE M KELLER	44	167
GLACIER BAY	69	158
GOLDEN ARROW	119	71
GOLDEN GATE	38	113
GRAND FELICITY	13	38
GREAT OCEAN	18	71
GREEN VALLEY	10	
GULF SHIPPER	2	68
H J HAYNES		13
HARUNA MARU	131	58
HESS VOYAGER	53	49
HOEGH MARLIN	1	69
HOEGH ORRIS	25	
HONSING BREEZE	14	
HOWARD W BELL	6	142
INACHUS STAR	26	104
IRIS QUEEN	97	
J R GREY		84
JALAVAMUNA	8	
JAPAN AMBROSE	42	33
JEAN LYKES	25	
JOHN PENN	24	
KASHU MARU	39	9
KOREA PHOENIX	1	
KOREAN LEADER	6	21
KUNGSHAMN	1	
LAKE ALMANOR	7	25
LASH ATLANTICO	19	49
LEO	23	
LIBRA	1	39
LONG BEACH	1	21
LURLINE	37	104
MAMMOTH FIR	2	74
MANIEK	2	82
MANULANI	78	138
MARCONA CONVEYOR	24	58
MARGARET JOHNSON	19	41
MARIAS TAO-57		108
MARJORIE LYKES	23	36
MAUI	82	126
MAYAYAN REEFER		6
MENESTHEUS	36	

TOTAL WEATHER REPORTS RECEIVED FROM US COOPERATIVE OBSERVING SHIPS   JANUARY AND FEBRUARY 1980

SHIP NAME	VIA RADIO	VIA MAIL		VIA RADIO	VIA MAIL		VIA RADIO	VIA MAIL		VIA RADIO	VIA MAIL
MEDNIA	43	66	META REITH	6		MIDAS RHEIN	11		MIDGETT WHEC 726	80	
MINE	1		MILLER FREEMAN	85	117	MILROSS	6		MINERVA	6	
MING AUTUMN	37	63	MING HOPE	1	3	MING SPRING	35	38	MING WINTER	1	
MING YOUNG	39	57	MOBIL AERO	22	91	MOBIL ARCTIC	33	94	MOBIL LUBE	55	103
MOBIL POWER	11	89	MOBILE MERIDIAN	41	117	MOBILFUEL	35	66	MOBILGAS	32	57
MOBILOIL	8	26	MONMOUTH	11	59	MONTERREY	7	12	MOON RIVER		47
MORMACALTAIR	20	74	MORMACARGO	18	45	MORMACDRACO	24	75	MORMACGLEN	12	63
MORMACLYNX	15	62	MORMACRIGEL	17	49	MORMACSAGA	31	83	MORMACSEA	12	44
MORMACSKY	4	9	MORMACSTAR	12	86	MORMACSUN	48	145	MORMACTIDE	5	73
MORMACVEGA	15		MORMACWAVE	6	48	MORNING GLORY	28	53	MOUNT VERNON VICTORY	13	6
MT MITCHELL	6	11	MUNDOGAS AMERICA	11	19	NAGARA	14		NANCY LYKES	25	73
NAVASOTA		44	NECHES	8	32	NEPTUNE RUBY	54		NEW GOLDEN PHOENIX	49	86
NEW JERSEY MARU	93	23	NEWARK	53	95	NEWCASTLE CLIPPER	22		NODAWAY	71	57
NOPAL LANE	32		NOPAL SEL	10		NOPAL VERDE	6	18	NORDIC LOUISIANA	34	
NORDIC PRINCE	54	16	NORSE PILOT	67	84	NORTHWIND WAGB 282	124	139	OAKLAND	1	
OCEAN CROWN	9		OCEAN DUKE	7	13	OCEAN HAPPINESS	14		OCEAN LOG	8	4
OCEANIC	75	156	OCEANOGRAPHER	116	144	OGDEN CONGO	95	180	OGDEN FRASER	26	
OGDEN JORDAN	3		OGDEN WILLAMETTE	46	93	OJI GLORIA	47		OLEANDER	115	128
OLGA MAERSK		38	OLGA TOPIC	38	28	ORANGE	7		ORCO MINER	6	8
ORCO TRADER		37	ORE JUPITER	52	74	ORE MERIDIAN	19	103	ORIENTAL COMMANDER	14	36
ORIENTAL ESEARCHER	7	15	ORIENTAL EXECUTIVE	21	127	ORIENTAL JADE	1		ORIENTAL LEADER	16	
ORIENTAL QUEEN	15		ORIENTAL SOVEREIGN	29	37	ORIENTAL STATESMAN	20	77	OTTO N. MILLER	22	213
OVERSEAS ALEUTIAN	1		OVERSEAS ARCTIC	15	25	OVERSEAS CHICAGO	18	40	OVERSEAS JUNEAU	40	158
OVERSEAS NEW YORK	4	23	OVERSEAS VALDEZ	5		OXFORDSHIRE	2		PACBARON	7	43
PACBARONESS	18		PACDUCHESS	17	13	PACDUKE		19	PACEMPEROR	7	
PACGLORY	13		PACIFIC ACE	15	85	PACIFIC ARROW	90	59	PACIFIC ERA	30	18
PACIFIC EXPRESS	92	49	PACIFIC PEACE	22	54	PACIFIC SAGA	52	129	PACIFIC VENTURE	59	182
PACIFIC WING	1		PACKING	3		PACMAJESTY	13		PACMERCHANT	7	12
PACPRINCE	4		PACPRINCESS	23	17	PAN ASIA	4		PAN PACIFIC	32	114
PAN WESTERN	25	17	PARALLA	28	30	PAUL L FAHRNEY		120	PEIRCE	5	
PENNMAR	7	22	PEREIRA D'ECA	15		PERRYVILLE	5	38	PERSIAN REEFER	24	
PHILADELPHIA	35	78	PHILIPPINE CORREGIDOR	1	43	PIONEER COMMANDER	13	65	PIONEER CONTENDER	23	73
PIONEER CONTRACTOR	27		PIONEER CRUSADER	5		PIONEER MOON	23	62	POLAR ALASKA		159
POLAR SEA	134		POLAR STAR WAGB-10	28		PORTLAND	34	73	PRESIDENT ADAMS	17	39
PRESIDENT CLEVELAND	13		PRESIDENT FILLMORE	48	103	PRESIDENT JACKSON	25	25	PRESIDENT JEFFERSON	40	144
PRESIDENT JOHNSON	70	143	PRESIDENT KENNEDY	61	111	PRESIDENT MADISON	56	131	PRESIDENT MC KINLEY	59	92
PRESIDENT PIERCE	74	154	PRESIDENT POLK	72	115	PRESIDENT TAFT	77	127	PRESIDENT TAYLOR	3	
PRESIDENT TRUMAN	57	68	PRESIDENT VAN BUREN	45	115	PRESIDENT WILSON	13	48	PRINCE OF TOKYO	20	
PRINCE WILLIAM SOUND	28	92	PROSPERITY	14		PUERTO RICO	5		PURE OIL	33	91
PVT JOHN R TOWLE	8	147	PVT LEONARD C BROSTROM	33		QUEENS WAY BRIDGE	75	56	QUESHET	1	
QUINTINA	9		QUIXADA	35	30	R G FOLLIS	8	103	RED ARROW	20	25
RELIANCE WHEC 615	5		RESEARCHER	63	143	RESOLUTE WPC 620	4	4	RICHARD	36	74
RIGOLETTO	2	2	RIO COBRE	1		RIO OLIVIA	20	22	ROBERT E LEE		20
ROBERT TOOMBS	13		ROBERTSBANK	18	70	ROMANDIE	15		ROSE	1	144
ROSE CITY	23	46	ROYAL VIKING SEA	14		ROYAL VIKING SKY	94	12	ROYAL VIKING STAR	54	73
RUSH WHEC 723	18	66	RUTH LYKES	9	51	SACRAMENTO	1	48	SACRAMENTO VENTURE		7
SALVADOR	28	36	SAM HOUSTON	11		SAM RATULANGIE	12		SAMOA	29	47
SAMUEL CHASE	4	27	SAMUEL S	1		SAN FRANCISCO	80	44	SAN JUAN	59	98
SAN MARCOS	39	29	SANKOSTAR	20	23	SANKOSUN	11		SANSINENA II	19	12
SANTA BARBARA	2	14	SANTA CLARA		43	SANTA MAGDALENA	51	101	SANTA MARIA	51	94
SANTA MARIANA	15	95	SANTA MERCEDES	15	36	SARGODHA	24	2	SEA FAN	26	
SEALAND COMMERCE	58	119	SEALAND CONSUMER	47	71	SEALAND ECONOMY	52	115	SEALAND EXCHANGE	36	111
SEALAND FINANCE	42	99	SEALAND GALLOWAY	33	62	SEALAND LEADER	39	106	SEALAND MARKET	20	65
SEALAND MCLEAN	43	132	SEALAND PIONEER	33	111	SEALAND PRODUCER	17	118	SEALAND RESOURCE	49	97
SEALAND TRADE	40	110	SEALAND VENTURE	26	106	SEATRAIN INDEPENDENCE	68	113	SEATRAIN LEXINGTON	76	172
SEATRAIN LOUISIANA	1		SEATRAIN ORISKANY	25	142	SEATRAIN PRINCETON	50	148	SEATRAIN TRENTON	93	77
SEATRAIN VALLEY FORGE	48		SEATRAIN YORKTOWN	46	182	SEAWAY	37	128	SEAWAY DISPATCH	15	74
SEDGE WLB 402	13		SHANGRI LA	44	100	SHERMAN WHEC 720		24	SHIRLEY LYKES	8	
SHUNWIND	57	122	SILVANA	27		SILVANA LOLLI GHETTI		139	SILVER LADY	15	21
SILVER PHOENIX	118	145	SILVERLIME		145	SINALOA	19	32	SINCERE NO 3	31	66
SINCERE NO 5	19		SINCLAIR TEXAS	8	18	SKAUGRAN	56	114	SKYWARD	22	
SNOW CRYSTAL	25	66	SNOW STORM	8	83	SNOWLAND	43	59	SOHIO INTREPID	23	68
SOLON TURMAN	26	126	SOUTHWARD	27		SOUTHWEST CAPE	8		SPERO	13	
SPRUCE	20	110	STADT BREMEN	18		STAR DIEPPE	5		STAR DOVER	8	67
STAR HONGKONG	22	4	STARWARD	18	22	STATE OF TRIPURA	6	10	STELLA LYKES	8	29
STINNES ZEPHIR	1		STOLT LLANDAFF	18	84	STONEWALL JACKSON	8		STORIS WAGB 38	16	50
STREAM HAWSER	8	15	STUYVESANT	20	37	SUCCESSFUL VENTURE	15	30	SUGAR ISLANDER	14	16
SUNWARD	6	54	SURVEYOR	24	39	SVENDBORG MAERSK	17	43	T F L LIBERTY		28
TAEPING	1		TAIKO VENTURE	17		TAKARA	30		TALUGA T-AO-62	45	74
TAMPA	35	63	TANEY WHEC 37		21	TAURUS	11	111	TEMA STAR	5	
TENNESSEE	9	20	TERRIER	33	71	TEXACO GHENT	9		TEXACO IOWA	8	17
TEXACO MARYLAND	1		TEXACO MISSISSIPPI	1	15	TEXACO MONTANA		16	TEXACO RHODE ISLAND	10	39
TEXAS SUN		36	TEXAS TRADER	9	30	TFL DEMOCRACY	21	119	THOMAS E CUFFE	72	131
THOMAS JEFFERSON	3		THOMAS MAERSK	4	20	THOMAS NELSON	8		THOMPSON LYKES	24	107
THOMPSON PASS	25	39	THREE STAR	6		TILLIE LYKES	40	121	TOBIAS MAERSK	28	32
TONBEI MARU	49	16	TOKYO RAINBOW	1		TONAMI MARU	97	55	TONCI TOPIC	8	56
TOWNSEND CROMWELL	138	194	TOYOTA MARU 10	116	61	TOYOTA MARU 12	73	92	TOYOTA MARU #3	94	57
TOYOTA MARU 1	17	22	TOYOTA NO 24	39	23	TRANSCHAMPLAIN	1		TRANSCOLORADO	28	62
TRANSCOLUMBIA	8	45	TRANSINDIANA	1		TREIN MAERSK	6		TRIUMPH	62	
TSU	31	71	TYSON LYKES	51	106	ULTRASEA	8	10	UNION CONCORD	35	43
UNION PROGRESS	1	19	UNIQUE FORTUNE	8		UNITED SEA ANGEL	12	62	UNIVERSE	29	
UNIVERSE KURE	16	145	VALIANT		24	VALLEY FORGE	2	18	VAN CONQUEROR	23	128
VAN ENTERPRISE	1		VAN FORT	5		VAN TRIUMPH	5		VAN WARRIOR	46	118
VANGUARD	22	51	VELPA LYKES	27	31	VENEZUELA MARU	31	25	VIGOROUS WMEC-627	2	35
VIOLET		46	VOLNAY	1		WALCHAND	22		WALTER RICE	32	113
WECOMA	105	175	WESER EXPRESS	57	93	WESTERN SUN	2	61	WESTWARD VENTURE	68	89
WHITE OCEAN	1		WILLI REITH	1		WILMINGTON GETTY	35	81	WORLD CANDOUR	9	110
WORLD HERCULES		24	WORLD MEDAL	27		WORLD PRIDE		48	WORLD SUPREME	14	20
YAMASHIN MARU	67	71	YOUNG AMERICA	67	112	YOUNG SEAGULL	34	89	YUKON T-AO 152	24	45
ZAMBOANGA	10	22	ZIM HONGKONG	11		ZIM MONTREAL	14		ZIM NEW YORK	35	112
ZIM TOKYO	19	41	ZOELLA LYKES	12	40	ATSI	2	8	AACV	5	54
A8IJ		45	A8TF	23	157	A8WA	19	137	BLHG	24	36
DMDK	64	48	DYXL		108	DZJF		133	DZHM	2	6
DZNR	2	14	DSCX	2	20	DSEF	65	19	DSHI		48
DSMC	31	24	DSND	18	23	DSNZ	53	81	DSOE	5	98
DSQC	19	57	DSTG	19	67	DSON		38	ELCJ	2	31
ELFY		122	ELOC	12	12	ELXT	1	103	ELYZ		8
HOMO	28	11	HOMV	12	50	HOQJ		16	H3SY		4
H3XV	11	26	H8BD		34	H8JO	14	68	H8LR	9	16
JKIO	17	22	JKLK	50	79	JLJL	60	57	JMZR	5	9
KAVE		55	KHFX		5	KHRF	11	39	KIEW		12
KJDG		5	ALEX		35	KLFY		12	KMWJ	48	94
KNCX	12	53	KNOK		5	KPGO		41	KPHZ	9	71
KPKL	17	32	KRBG		69	KSDK	11	20	KSFJ	22	78
KSFX	12	33	KSLB	19	64	KSLJ	54	135	KWMF		14
KWKE		2	LAAI		1	LEVX		14	LIQL		23
LIOZ	24	97	LRRP	4	5	N6DV	1	18	NLGA	27	40
NNBN		206	N6SI		61	NRIX		82	NTRI	4	90
OZIX		5	OWER		32	OXFU	47	118	S6AD	54	150
S6ED	8	9	S6HM	6	49	VPFW	54	88	VRCF	55	54
VRCH	25	29	WBMQ		9	WDJH		34	WDZB	10	60
WEZV		3	WFQE	1	95	WMJH		14	WNUM		12
WSRP	7	9	WYS3261		19	WZL8190		36	YXZS		8
ZCKV	87	104	ZFCB	39	70	ZFCL		52	3EBH	2	28
3EOR	4	42	3FHS	20	41	3FTF	34	21	5LOT	41	31
5LUP	15	105	5MOJ	7	22	5MRC	37	95	5MUE	73	150
6YSA	17	32	6ZBT	6	67	6ZOD	33	31	6ZHZ		10
6ZLN	20	43	6ZMN	36	90	6ZTD		28	9HTR	44	104
9MUT	67	140	9VGM		48	9WHD	18	19	9VMY	6	8
9VPV	50	166	9VVI	4	25	9VVT	78	149			

SUMMARY: GRAND TOTAL VIA RADIO 23580   GRAND TOTAL VIA MAIL 49095

Rough Log, North Atlantic Weather

April and May 1980

ROUGH LOG, APRIL 1980--This was an anomalous month over the North Atlantic. Neither the storm tracks nor the mean pressure pattern resembled climatology. Normally, there are two major storm tracks: one from the Great Lakes to Newfoundland where one branch splits into the Labrador Sea and the other continues eastward; and the second from off Norfolk to the Denmark Strait. This month there were a large number of storms over northern Canada. The Great Lakes Basin was a favorite area for cyclones, but they traveled in multidirections. Three storms approximated the climatological track along the U.S. East Coast toward the Denmark Strait. One of the busiest areas was the central ocean near the Azores.

During most of the month there was high pressure west of the English Channel. This was reflected in the mean sea-level pressure by an anomalous 1027-mb HIGH near 51°N, 16°W, and in the sparsity of observations over that part of the ocean and the LOWs near the Azores. The normal 1021-mb Azores High was shifted about 900 mi to the west near 30°N, 48°W. The Icelandic Low (1006 mb) was displaced from near Kap Farvel to the Greenland Sea with a second 1007-mb Low west of Iceland.

The primary feature on the sea-level anomaly chart was a plus 13-mb center west of Ireland. Higher-than-normal pressure dominated the latitude belt between 40° and 60°N, with a plus 8-mb center off Cape Race. There were two significant negative centers, a 5 mb over the Greenland Sea and a 4 mb over the central ocean near 34°N, 30°W.

There were also major differences from climatology in the upper air. The most prominent anomalous feature was a high center off Lands End reflecting the surface High. The normal trough off the East Coast was retrograded to the Great Lakes-Mississippi River area.

There were no tropical storms this month, and none would be expected.

Extratropical Cyclones--This was a rather quiet month with few severe storms. The anomalous high-pressure center west of Europe directed many storms far to the north and allowed some to form south and west of the Azores.

On the 1st there was a LOW off Norfolk. A ship near Cape Hatteras had 45-kn westerly winds. By the 2d the storm had moved to 38°N, 50°W (fig. 72). The TEMSE had 26-ft swell waves near 35°N, 54°W. On the 3d there was high pressure over the Bay of Biscay, and the storm turned toward the northeast. The SEA-LAND VENTURE (42°N, 36°W) had 50-kn winds and 36-ft waves. Other ships were finding gales in the southerly flow. By midday on the 4th the LOW abruptly disappeared.

This LOW formed north of Quebec in a col area between two HIGHs on the 2d. It moved southeastward and over water as a very weak circulation until the 4th, when it suddenly deepened and turned eastward.

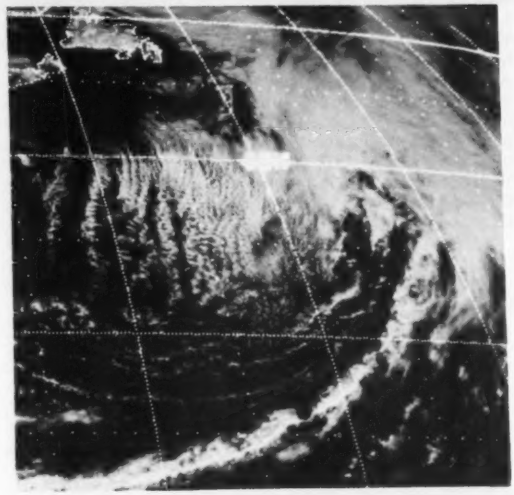


Figure 72.--By 1700 the storm has moved to near 39°N, 43°W. The TEMSE was under the heavy cloud southwest of the center.

It dropped 14 mb in 12 hr (fig. 73). At 1200 and 1800 three ships had winds over 60 kn. They were the SURENES (40°N, 51°W) with 46-ft swell waves, the ANCO CHALLENGER (43°N, 48°W) with 33-ft seas, and the YTNW which had the highest winds of 68 kn and 20-ft waves.

On the 5th several ships had winds near 50 kn. The RAVENSWOOD (37°N, 42°W) had 44-kn winds with 39-ft swells. The SEA-LAND CONSUMER (36°N, 43°W) had winds of only 40 kn, but the seas were 41 ft. The storm now turned southeastward again as a 1038-mb HIGH was centered over England. The storm was weakening on the 6th. It almost disappeared on the 9th, but it turned northward as high pressure moved eastward over the Continent. Although the LOW deep-

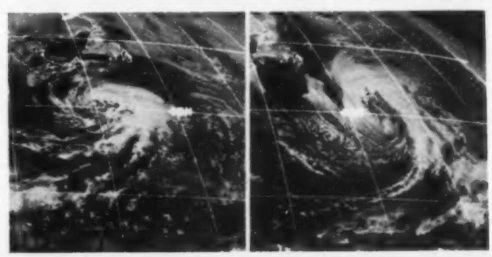


Figure 73.--The left image shows the storm at 1700 on the 3d; the right image shows it 24 hr later at 1700 on the 4th.

ened only slightly as it moved northward, it managed to survive into the 13th.

This storm came out of the Midwest and crossed the Great Lakes on the 4th. On the 5th the southerly flow was off the coast and the LASH ATLANTICO had 45-kn gales off Norfolk. At 1200 the LUGWIGSHAFEN EXPRESS (37°N, 65°W) found 55-kn southerly winds and 30-ft swells east of the front. The LABRADOR (46°N, 60°W) had 52-kn southeasterly winds. The storm turned northward as high pressure blocked further eastward movement. On the 6th the FYLLA (61°N, 48°W) had 60-kn easterly winds. On the 8th the storm was traveling through the Davis Strait (fig. 74). The GRONLAND found 44-kn winds and the KUNUNGUAK (66°N, 54°W) had 52-kn winds with 20-ft seas. Later in the day the storm broke into multiple centers.

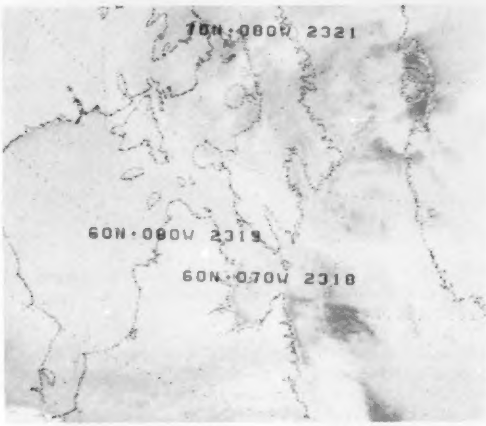


Figure 74.--It is difficult to distinguish between the clouds and the snow and ice in this infrared image as they are near the same temperature. Late on the 7th the LOW is south of Davis Strait.

This LOW split off on the southeast coast of Greenland from a LOW over the Greenland Sea. It drifted southward, widening its zone of influence. At 1200 on the 11th it was 990 mb at 60°N, 33°W. At 0600 that day OWS Lima had 44-kn winds from the south. The FYLLA, south of Frederikshab, in the northerly flow had 52 kn. On the 12th OWS Charlie had 40-kn winds and 21-ft waves. On the 13th the storm was on a northerly track and the RIGG east of the Shetland Islands measured 52-kn winds. As the storm crossed Iceland, it picked up speed and was over northern Greenland on the 15th.

A heat LOW near Monterey, Mexico, got a shove and raced across the Gulf of Mexico to near New Orleans at 1200 on the 13th. The buoys in the Gulf were reporting 20- to 30-kn winds. Late on the 13th the PURE OIL (27°N, 90°W) reported 58-kn northwesterly winds behind the cold front. She was reporting squalls at the time. On the 14th a station off Yucatan reported 40-kn winds. The LOW was moving northward across the Great Lakes on the 15th. Michigan produced this storm. On the 14th it was over the Gulf of St. Lawrence. As it moved over open and warmer water, it intensified rapidly. At 1800 the A.T. CAMERON on the Grand Banks had 55-kn winds. Several other ships had winds in the 40's. By 0000 on the 15th the LOW was 980 mb near 45°N, 47°W (fig. 75). The WVFN located 42-kn winds. The winds and waves were picking up. The FRANCISZEK ZUBRZYCKI and ATLANTIC CAUSEWAY both had 50-kn northwesterly winds with the former fighting 30-ft waves. Forty- to fifty-knot winds and waves up to 25 ft continued into the 16th.

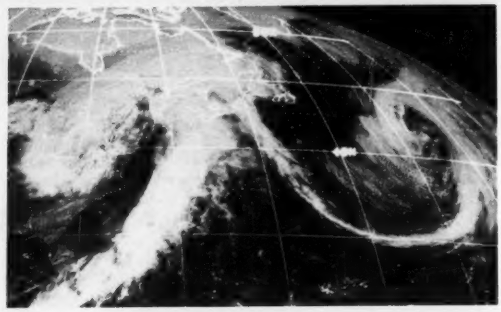


Figure 75.--At 1700 the storm is wound like a spring near 45°N, 35°W. The storm on the left over the Great Lakes is the one described above.

At this time high pressure was moving northward off Portugal, and the LOW turned southward. On the 17th the storm was weakened considerably as the HIGH built to 1040 mb off Ireland. It no longer existed on the 19th.

This was another LOW that formed over the east coast of Greenland in the backwash of another storm. It was 986 mb on the first analysis on the 17th. The large HIGH mentioned previously was centered on latitude 50°N between Cape Race and Lands End. At 1200 on the 18th the storm was 972 mb near 74°N, 03°W, with gales. On the 19th a second center joined the overall circulation over Sweden. Strong cold winds were pouring down from the Arctic over the Norwegian and North Seas. Platforms and ships were finding winds ranging from 40 to 60 kn. The POLARSIRKEL had 60-kn winds below minus 5°C for over 12 hr in the vicinity of 74°N, 08°W. The waves increased rapidly with many of the platforms having waves near 30 ft. One at 64.3°N, 2.6°W, had 54-kn winds and 43-ft waves. Another at 60.8°N, 1.4°E, had 50-kn winds and 49-ft waves.

By 1200 on the 19th the southern LOW was the major circulation at 960 mb (fig. 76) and the original LOW was fading. On the 20th a British reporter called the winds 58 kn and the seas 30 ft, but they were subsiding as the storm traveled southeastward and then northeastward. On the 21st it was back over the Arctic Ocean.

The northerly winds with this storm resulted in one ship sinking, several damaged with damage to locks and dolphins in the Kiel Canal, and coastal damage in the Netherlands. The ALTMARK sank off Rotterdam after shipping water through a broken hatch. One crewman died, one was missing, and three were rescued by helicopter. Ships with problems in the Kiel Canal were the

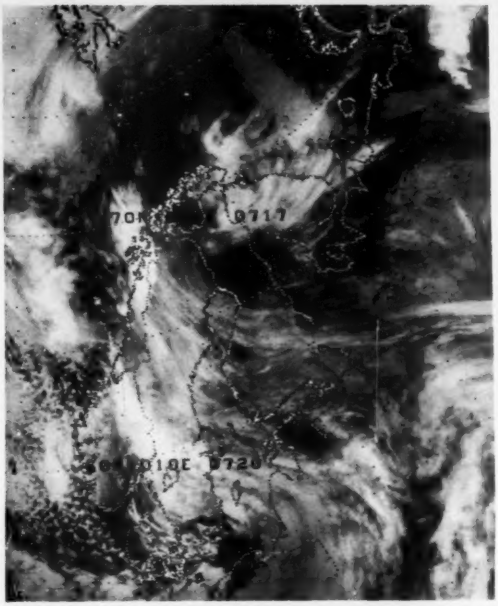


Figure 76.--The dry, cold northern air does not produce the dense clouds expected with such a deep storm. High-level clouds also obscure the surface centers, which are near 72°N, 10°E, and 60°N, 17°E.

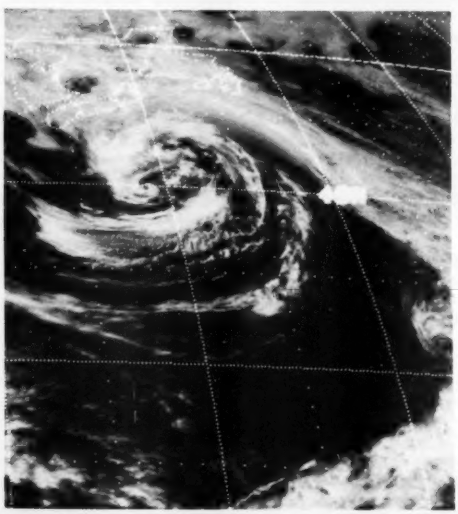


Figure 77.--Notice the comma- or hook-shaped cloud just left of the center. This usually designates an area of severe weather.

JOH GORTHON, DENIZATI, INOWROCLAW, LEOPOLD STAFF, and JUNIOR LILIAN.

This storm was the product of several LOWs, one of which was a subtropical LOW which formed off Cape Kennedy on the 20th. As it drifted northward and eastward, several other centers materialized. On the 23d yet another center was found off Cape Cod which was to become this storm. Ships identified as VC24 and CG11 near Nova Scotia had 45-kn winds from the east at 0600. The CHERRY (40°N, 56°W) had 52-kn winds, and the SNOW BALL (39°N, 50°W) had 23-ft waves. On the 24th at 1200 the circulation had completed its consolidation into one center (fig. 77). The HUDSON (46°N, 57°W) found 48-kn winds. A ship south of the center had 40 kn and 20-ft waves. From now until the 28th it appeared that the storm would dissipate, but that day it revived. A ship at 48°N, 40°W, had 40-kn winds and 23-ft seas. On the 30th a British ship found 23-ft swells in the southerly flow, but the storm center was gone the next day.

Casualties--This was the month for ice damage. In the early morning of the 2d the Liberian 35,450-ton AMOCO CREMONA and the American 7,189-ton MASON LYKES (fig. 78) collided in fog near the entrance to Galveston Bay. Both vessels caught fire. The crew of the AMOCO CREMONA abandoned ship but later reboarded and extinguished the fire. The Greek ION encountered heavy weather on the 4th and diverted to Norfolk. The Danish JUNIOR LONE struck ice and damaged her hull on the 6th at Baie Verte, Newfoundland. Wind, waves, and ice forced the COURTNEY BURTON to broach toward the Duluth ship canal breakwall approaching Duluth harbor on the 8th. The severe conditions prevented tugs from helping, and she dropped anchor. The Dutch LOOSDRECHT reported heavy weather damage at Saint John, New Brunswick, on the 7th.

On the 10th the Yugoslavian BANIK and the FANTI collided during a strong gale at Guyana. On the 11th the 748-ton CAPE D'OR was holed by ice and sank near 53°N, 52°W. The trawler CAPE LA HAVE was holed by ice off Labrador on the 12th. The Canadian Coast Guard dropped pumps, and the vessel was able to make St. John's, Newfoundland.

The CHICAGO TRIBUNE (3,595 tons) encountered heavy ice near Whitefish Point on the 13th, which caused slight cracks in her bow. The 19,160-ton RALPH MISENER also suffered ice damage from a large ice floe while departing Quebec--day unknown. The 2,272-ton FORTUNA REEFER suffered heavy weather enroute from Savannah to Montevideo.

The bulkcarrier MEDSTAR put into Cadiz on the 16th with weather damage. The 4,145-ton Egyptian AL KAHERAH encountered bad weather with internal damage which was reported at Alexandria on the 24th. Late in the month the PAUL H. TOWNSEND responded to a distress signal from the fishing tug JENNY LOU on Green Bay. The tug's engines had failed to start in strong seas. The TOWNSEND shielded the tug from the seas until the USCG MOBILE BAY arrived.

Other Casualties--The MAURITIUS II sank on the 17th off Durban. The crew was rescued by the ALFA-RAHIDI. The vessel apparently encountered "Cape Rollers" in the Agulhas Current. A number of trawlers and fishing vessels were damaged in strong currents in the River Quequen, Buenos Aires, after torrential rains. Also, the LADY SOPHIE apparently suffered cargo damage. The South Korean WOLJONG grounded in strong winds in the Gulf of Aqaba.

Figure 78.--The 540-ft MASON LYKES waits to enter Galveston Bay still shrouded in the fog in which she and the AMOCO CREMONA collided. Damage to her bow is visible. Wide World Photo.

ROUGH LOG, MAY 1980--This was another anomalous month across the North Atlantic. There appeared to be fewer storms and they were widely scattered, especially over North America. Ordinarily, there are three primary tracks over water. One is from the Great Lakes to the Gulf of St. Lawrence, where it splits to the Davis Strait and Denmark Strait. Another is from Delaware Bay northeastward to the Norwegian Sea. A branch splits off this one to the Orkney Islands. A secondary track enters Europe over the Bay of Biscay. This month the only concentration of storm tracks was from the U.S. East Coast northeastward to the Flemish Cap, then northward to the Denmark Strait. Only two storms entered Europe from the west, and they were in the first week.

The Icelandic Low on the mean sea-level pressure chart was divided into two centers this month, both far from Iceland. One 1009-mb center was at 50°N, 35°W, and a 1010-mb center was over Cape Race. This compares with a climatic 1009-mb LOW near 58°N, 35°W, and a 1014-mb center near Oslo. The Azores High at 1024 mb at 30°N, 30°W, was about 400 mi east of its climatic normal of 1022 mb. A ridge of high pressure extended from the Azores High northeastward toward Cape Finisterre, then northward over the Irish Sea, and on to a large 1032-mb High over the Arctic Ocean. A small 1021-mb High was near the Faeroe Islands.

There were two major anomaly centers, both 7 mb. The minus 7 mb was near 45°N, 35°W, and the plus 7 mb was near the Faeroe Islands. There was also a minus 4-mb center over the Mediterranean Sea, but ship information did not indicate any severe storms.

The upper air pattern at 700 mb reflected the paths traveled by the surface cyclones. The primary center of circulation was higher than normal but normally located over Devon Island. A second center was off Marys Harbor, Labrador. The long-wave trough was shifted from 65°W longitude to 55°W longitude over Newfoundland but was near normal at 70°W and 30°N. An anomalous HIGH was over the North Sea, which greatly accented the usual slight ridging over Iceland and Greenland.

There were no tropical cyclones.

Extratropical Cyclones--High pressure over the northern ocean continued from April into May. By May 7 the HIGH had built to 1046 mb over northern Greenland, and its influence extended southward to latitude 50°N (fig. 79).

This first storm of the month was found east of Newfoundland on the 0000 analysis of the 2d. At 1200 the C.P. TRADER found 52-kn winds with 20-ft waves, and the MAERSK COMMANDER had 44-kn winds with 15-ft waves, both in the southwest quadrant in the vicinity of 47°N, 42°W. At this time the LOW was 991 mb near 50°N, 41°W. The storm was moving slowly eastward against a blocking 1035-mb HIGH over the Norwegian Sea. The ATLANTIC SAGA had 44-kn north-

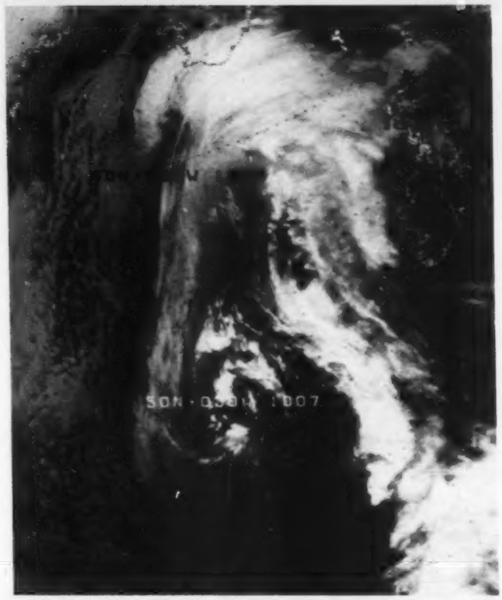


Figure 79. --By 1200 on the 8th the high pressure has dropped to 1037 mb with two centers, one over the central ice caps and the other over western Baffin Bay. A weak LOW south of Iceland is pushing northeastward.

Figure 80. --There were two centers with this storm. A weak one near 58°N, 23°W, and the principal one near 49°N, 28°W.

westerly winds blowing on her starboard bow at 1200 on the 3d while about 400 mi west of the LOW.

On the 4th the storm dropped 3° latitude to the south as it traveled south of the HIGH. On the 5th the MARITIME DOMINION (49°N, 10°W) was east of the LOW with 48-kn winds. The storm was weakening as it moved between high pressure to both the north and south. On the 8th it crossed into France and disappeared.

As a LOW that had originated off Cape Hatteras passed over the Grand Banks, it dissipated; and another formed near the Flemish Cap on the 7th. The CETRA VELA (49°N, 38°W) was northeast of the storm's center with 56-kn winds. At 1200 on the 8th the storm was 990 mb near 48°N, 35°W. Two ships reported winds over 50 kn. They were the CETRA VELA (48°N, 45°W) with 58 kn and the MARITIME DOMINION (44°N, 37°W) with 52 kn. The RUBENS (51°N, 35°W) was only 2 kn below 50 kn. The highest waves were 23 ft.

On the 9th the storm turned northward as the Arctic High weakened and retreated. At 1200 the 984-mb storm was near 51°N, 27°W (fig. 80). The RUBENS now had 55-kn winds with 20-ft seas and 39-ft swells. A ship near 60°N, 28°W, had 33-ft swells. Much farther south the SEA-LAND RESOURCE entertained 50-kn winds from the south. On the 10th the strong easterly circulation reached the Icelandic fishing fleet and they reported winds over 50 kn. A ship off Ireland had 25-ft waves. On the first observation on the 11th OWS Charlie had 45-kn winds with 20-ft seas. The storm was weakening and by the 12th had broken up into three centers and was no longer any threat.

Over the next 10 days this ocean was relatively quiet. Many circulation centers, both cyclonic and anticyclonic, traversed the water, but none caused much excitement.

On the 19th a frontal wave formed over the Texas Gulf Coast. At 0600 on the 21st it was over Norfolk (fig. 81). At 1200 the DELAWARE GETTY was north

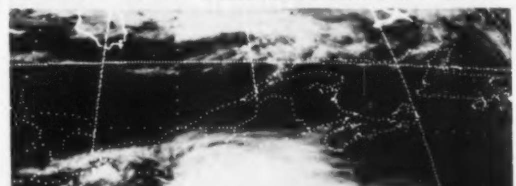


Figure 81. --At noon local time the storm has moved offshore.

of the Bahamas with gales from the south. As the storm traveled along the Gulf Stream, it broadened its circulation and on the 23d was near Cape Race at 980 mb. Ships in the vicinity of 46°N, 50°W, were now finding gales. A U.S. ship reported 50-kn winds near 47°N, 49°W. Another ship nearby had 21-ft waves. The storm stalled at this point and remained stationary through the 25th.

Back to the 23d. At 1800 the PEGASIA was near 48°N, 47°W, with 60-kn southeasterly winds. On the 24th the winds over the Grand Banks were generally gales, but the ATLANTIC CONVEYOR (47°N, 40°W) had 44-kn winds with 23-ft seas and swells. The storm was gradually weakening, and on the 26th a frontal wave traveled south of it contributing to the process. The LOW finally disappeared from the analysis on the 29th.

A series of frontal waves traveled northeastward south of the storm above as it moved slowly northward. One of these persisted and by the 29th was forming a good circulation. Late that day the MEONIA with 39-kn winds was not far from OWS Romeo, which was reporting 21-ft waves.

The storm had been moving northeastward, but on the 30th the center suddenly jumped westward. It absorbed the LOW described above with a realinement of the upper air pattern. The AFANASIY NIKITIN (56°N, 35°W) was caught in this with 41-kn winds and 26-ft seas. At 1200 the MIROSLAWIEC (56°N, 34°W) was contending with 47-kn winds. No seas were reported. A few gales continued to be reported on the 31st, but the storm was deteriorating rapidly.

Casualties--The 6,739-ton Brazilian LLOYD BAGE struck ice floes off Helsinki and leaked fuel oil. The Norwegian tanker LAKE ANJA arrived St. Johns with ice damage. The American wood auxiliary vessel AR-

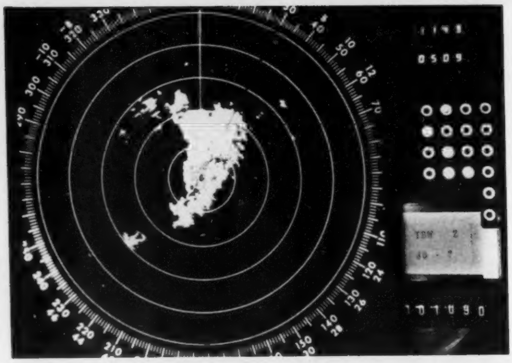


Figure 82.--This radar photograph was taken at 1143, 9 min after the SUMMIT VENTURE rammed the Sunshine Skyway Bridge. The radar site is approximately 15 mi northeast of the bridge.

TEMIS sank in rough weather in the Gulf of Mexico on the 9th. The tug OCEAN SUN rescued all the crew. The 19,734-ton SUMMIT VENTURE (front cover) collided with the Sunshine Skyway Bridge in Tampa Bay, Fla., during a thunderstorm (fig. 82). A bus and five vehicles fell off the bridge before it could be closed, with 35 lives lost.

The Liberian ARHON requested heavy-weather survey at Marseilles on the 12th. The 3,313-ton RIO SULACO reported heavy-weather damage on the 12th on arrival at Havre. The roll-on/roll-off vessel IVA suffered heavy-weather damage prior to the 21st. The ore carrier AL TAWWAB suffered heavy-weather damage on a voyage from Port Elizabeth to Taranto.

Rough Log, North Pacific Weather

April and May 1980

ROUGH LOG, APRIL 1980--The storms crossing the ocean this month appeared to be deeper than normal and lasted longer. This is reflected in the strong Aleutian Low. Climatology indicates the primary storm path is from Japan to Bristol Bay. There is another track from Asia into the Sea of Okhotsk and yet another from south of the Fox Islands that forks into the Gulf of Alaska and Queen Charlotte Sound.

This month the primary track was from Hokkaido into the Gulf of Alaska, touching the Aleutians at the date line. At midocean, about 600 mi south of the Aleutians, a secondary track curves into the Gulf of Alaska. Several storms moved toward the British Columbia coast, but were from the south rather than the west. None crossed into the interior.

The climatological normal sea-level pressure chart indicates four Low centers of 1009 to 1010 mb from the Kenai Peninsula to the Sea of Okhotsk. The Pacific High is elongated along latitude 30°N with a maximum pressure of 1023 mb. This month the mean analysis was more intense with one 994-mb Aleutian Low centered about 200 mi south of Kodiak Island. The 1027-mb Pacific High had its maximum pressure center at 32°N, 180°, 1,700 mi west of its normal location.

There were two major anomaly centers: a minus 18 mb near 52°N, 155°W, and a plus 6 mb near 32°N, 177°E. A third anomaly center that could have affected this ocean's weather indirectly was a plus 13 mb over the Arctic Ocean near 79°N, 160°E.

There was also quite a difference in the upper air pattern at 700 mb. This consisted primarily of an anomalous deep Low near Unimak Island. This in conjunction with the 700-mb subtropical High being 64 m higher than normal produced a tighter gradient with higher windspeeds.

Tropical storm Carmen formed over the western ocean.

Extratropical Cyclones--This first storm of the month was analyzed off Honshu on the 1st. The SUNNY WEALTH north of the warm front reported 41-ft swell waves. The LOW was moving through the circulation of an older system along the Aleutians. On the 3d the SPRAY CAP (37°N, 167°W) reported 55-kn winds and

a ship at the warm front had 20-ft waves. On the 4th she was west of the cold front with 58-kn winds. The SPRAY CAP was traveling with the storm, but being left farther behind. She had 50-kn winds on the 5th. The ALSATIA found 20-ft swell waves at 35°N. On the 6th the JAPAN ACE (44°N, 133°W) was south of the LOW with 45-kn winds and 26-ft waves (fig. 83). On the 7th the storm died on the rugged coast as the QUADRA caught 68-kn winds off the coast.

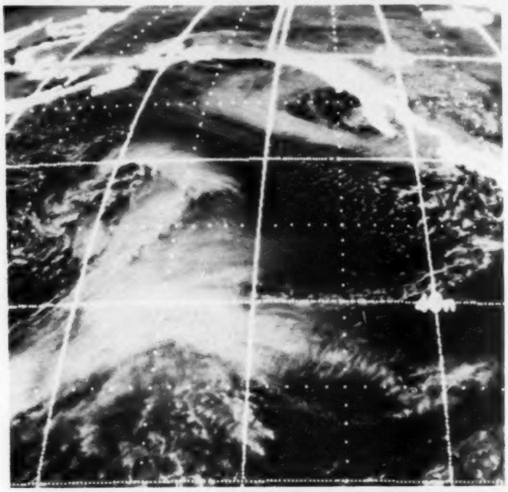


Figure 83.--The storm is near Dixon Entrance as another storm is moving into the Gulf.

This LOW appeared to burst out of nowhere into a full blown storm late on the 6th. The 0000 analysis of the 7th showed a 980-mb LOW at 46°N, 172°W. Four ships had gales between 40 and 45 kn. At 1800 the HIRA MARU (41°N, 155°W) had 44-kn winds with 33-ft swell waves. On the 8th the reported winds were in the 40-kn range with sea waves up to 21 ft. The sea-wave analysis showed an area of sea waves over 20 ft between 40° and 45°N and 150° to 155°W. The LOW was now 964 mb near 49°N, 157°W(fig. 84). The GLACIER BAY (46°N, 152°W) was behind the occlusion with 30-ft swell waves; 300 mi south a Japanese vessel had 33-ft swells. The LOW disappeared almost as fast as it grew and was gone by the 10th.

This LOW came out of the Sea of Japan and followed the LOW above. At 0000 on the 7th it was 992 mb near 46°N, 157°E. The SOUTH EXPRESS (36°N, 148°E) had 50-kn winds near the cold front with 20-ft waves. The PRESIDENT MADISON had 40-kn winds on the 8th. At 1200 the SHINSHO MARU (44°N, 164°E), about 450 mi southwest of the storm radioed 55-kn winds and 20-ft seas. Two ships had 50 kn on the 9th. At 1200 the SEA-LAND EXCHANGE was within 1 mb of the storm's center. The storm curved southeastward on the 10th and immediately started to weaken, but circulation persisted as it moved over the Pacific High. On the 13th the storm turned northeastward again and intensified. A ship near 32°N, 141°W, found 52-kn winds, and sev-

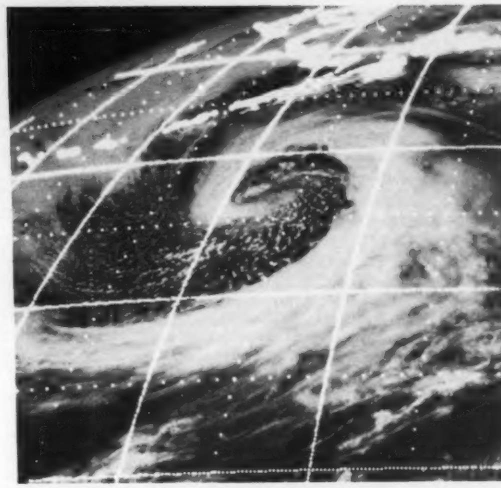


Figure 84.--This image at 2045 on the 7th shows the area of maximum seas southeast of the center and associated with the front.

eral others found 40 kn before the storm died out over Vancouver Island on the 15th. It had made the journey from coast to coast.

An inverted trough from Asia moved over Japan, and this LOW formed over the Kuroshio Current. By the 10th it was 990 mb off Ostrov Simushir. Several ships

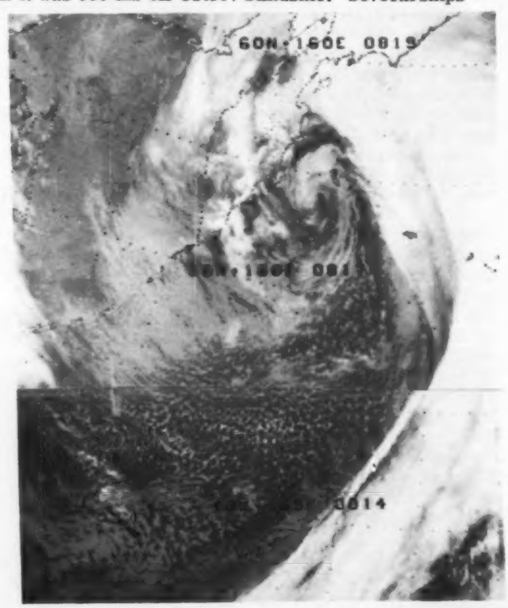


Figure 85.--At 0818 the storm is south of Ostrov Beringa.

had gales, and the JAPAN ACACIA (42°N, 168°E) reported southeasterly 66-kn winds with 20-ft waves. On the 11th the pressure had continued to drop to 969 mb as the storm moved along the Kurile Islands (fig. 85). Many ships had gales with several near 50 kn, but high waves were their worst problem. The NEPTUNE EMERALD, NEPTUNE SAPPHIRE, and SINCERE No. 3 in the vicinity of 48°N, 160°E, all had waves over 30 ft.

The high winds and waves continued through the 12th in the area around 50°N, 165°E. The NEPTUNE SAPPHIRE had 49-kn winds and 43-ft waves, while the JAPAN ACE had 58-kn winds with 39-ft waves. Others were reporting waves over 30 ft. On the 13th the storm encompassed two more LOW centers across the Bering Sea. A frontal wave was traveling through the southern perimeter of the storm and became the primary center on the 14th.

The frontal wave with the previous storm dissipated near the Shumagin Islands, and this one formed in its wake. The storm was born with isolated gales and waves to 20 ft. On the 15th it was curving northward to make a cyclonic loop over the Gulf of Alaska. It was of little concern until the 17th, when it started to consolidate the circulation. The MANHATTAN (51°N, 136°W) was in the southerly flow with 45-kn winds and 21-ft waves. These increased to 50 kn and 33 ft on the 18th. The G.B. REED at 52°N, 131°W, had 45 kn later in the day.

On the 19th this was a large 970-mb storm, but the winds reported were only minimal gales, except for 54 kn by the MAPLE ACE off the Queen Charlotte Islands. The storm rapidly dissipated on the 20th.

This storm came out of central Asia and deepened as it moved over Manchuria. On the 19th its eastern circulation reached the Sea of Japan. At 0000 on the 20th it was 984 mb over central Manchuria. The southerly winds were now east of Honshu. Ships north of Tokyo to Hokkaido were receiving winds up to 52 kn, which was reported by the OGDEN FRASER. The waves were less than 20 ft.

On the 21st a new center formed west of the Kurile Islands and frontal waves were moving over Japan. This broke up the circulation, and the winds decreased.

This LOW was a Japanese export. Twenty-four hours after it was first analyzed it was a small tight 989-mb storm at 0000 on the 18th. The CRYSTAL STAR was sailing east into 33-ft swell waves east of the center. The storm passed within 100 mi of the MENELAUS with 44-kn winds and 30-ft seas. On the 19th the BAHAMA MARU (37°N, 161°E) was contacted by 45-kn winds and 21-ft waves. Several ships had 45-kn winds on the 20th (fig. 86). On the 21st two Japanese ships had gales as the LOW passed between them. The KSBK was near Montague Island with southeasterly 60-kn winds and 33-ft waves. The storm was 964 mb near Kodiak Island. There were still gale reports on the 22d. Later in the day the storm deteriorated rapidly as it moved over land.

There were several weak LOWs and frontal waves east of Hokkaido on the 22d. This storm developed from one of these. Gales were occurring on the 23d. The KATORI MARU in the warm sector had 43-kn winds. The BUNGA MELAWIS (50°N, 175°W) had 50-kn winds from the north. On the 24th the SINALOA (48°N, 169°W) had

Figure 86.--The storm is centered near 50°N, 180°. The front stretches far to the south and then curves back northward into the Manchurian storm. The dense clouds on the left are associated with that storm.

50-kn winds and 26-ft seas and a ship near 46°N, 159°W, had 33-ft waves. The winds continued at about 40 kn, with several reports of waves over 30 ft along the coast. On the 26th the storm fell apart.

Figure 87.--The storm was due east of OWS Papa at 2045. The ship with the 63-kn winds was about 100 mi south of the center.

This was a short-lived storm. It formed in a short-wave trough late on the 22d near 46°N, 150°W. At 1200 on the 23d it was 986 mb near 49°N, 142°W. There were only reports from buoys and OWS Papa at that time. At 1800 Papa had 42-kn winds and 16-ft seas (fig. 87). Not far away (47°N, 141°W) a ship had 63-kn winds and 26-ft waves. The LOW above was moving into the area, and by the 25th it had completely absorbed this circulation.

Monster-of-the-Month--A long front stretched from a LOW near the Fox Islands to the Philippine Sea. On the 26th someone snapped the string, and a frontal wave formed near 37°N, 157°E. By the 27th there were gales and heavy rain with the storm. The DAISHIN MARU, west of the center, found 54-kn winds.

By 0000 on the 28th the storm was 972 mb at 43°N, 179°W. The PRESIDENT GRANT (42°N, 176°E) found northerly 55-kn winds with 41-ft swells. Two other ships reported winds over 50 kn. At 1200 a ship at 45°N, 180°, called the seas 41 ft (fig. 88). At 0000 on the 29th there were two observations of 78 kn with only one ship reporting waves, and these were very low for that windspeed. The pressure gradient would not appear to support this high wind, but both were positioned relative to the center where higher winds generally occur, and the pressures and direction fit the analysis. One was by the OGDEN FRASER at 48°N, 155°W, and the other by the PRESIDENT GRANT at 40°N, 175°W. There is a possibility that the wrong wind indicator was used, and the speed was doubled in converting to knots.

On the 30th the LOW was near Kodiak Island. The NORSE PILOT was 1,000 mi to the southwest with 30-ft swell waves. Another ship was 750 mi to the southeast with 23-ft swells. The storm stalled over the Gulf of Alaska on May 1 and disappeared on the 2d.

Tropical Cyclones, Western Pacific--Carmen, first tropical storm of the western North Pacific, meandered into the eastern waters to bring their first activity also. She actually began as an active cluster near 4°N, 178°W, on the 4th. Carmen drifted into western waters and began to organize by the 5th. By 1200 she was a tropical storm. Twenty-four hours later her winds peaked at 60 kn. At this time Carmen was near 17°N, 177.5°E, and recurving northeastward. She crossed into eastern waters on the 7th. The following day Carmen dissipated.

Casualties--On the 5th and 6th storms hit South Korea leaving at least nine people dead and over 300 homeless due to floods, landslides, and vessel damage. The IN WANG No. 2 (4,238 tons) dragged anchor and went aground. Fourteen other vessels grounded, capsized, or collided in Busan Harbor. The American tanker SPIRIT OF LIBERTY had heavy-weather damage repaired in San Francisco on the 9th. The 6,573-ton Panamanian OCEAN PROGRESS shipped heavy seas on the 16th, flooding the steering room and causing other damage. The Thai JUTHA RAJATA was at Kobe on the 28th with weather damage. That day the fishing boat GYOSEI MARU capsized and sank off Cape Nojima. Only 2 of 23 crewmembers were rescued. A construction boat, KYOEI MARU also capsized with the four crewmen missing.

Other Casualties--Storms hit Bangladesh on the 19th and 20th. A motor launch carrying 300 people capsized with 200 unaccounted for. The drilling vessel REGIONAL ENDEAVOUR was damaged in heavy weather off Dampier on the 20th when an anchor chain broke.

ROUGH LOG, MAY 1980--May was a relatively pacific month on the North Pacific. The storms were not so severe, and their number was limited. There were two primary storm tracks. One was from Hokkaido to the Pribilof Islands and the other from Honshu to Bristol Bay. Three storms crossed the Gulf of Alaska. The primary difference from climatology was that the storms ended over the eastern Bering Sea rather than in the Gulf of Alaska.

The mean sea-level pressure was more intense than the long-range normal. The Aleutian Low was one 1000-mb center near 55°N, 175°W, rather than three 1009-mb Lows stretched across the Bering Sea. The Pacific High was 1028 mb near 34°N, 145°W, 5 mb higher than normal, but very near its normal location.

The anomaly centers closely matched the pressure centers. A minus 10 mb was near 56°N, 172°W, and a plus 5 mb was near 39°N, 145°W. There was a second

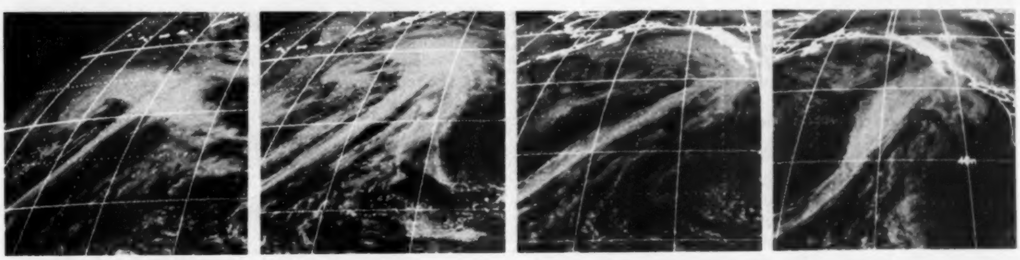


Figure 88.--This series of four images traces the storm at 2045 from the 27th to the 30th.

plus 5-mb center near 34°N, 170°E, associated with a secondary Pacific High center. Although not directly affecting this ocean's weather, the pressure of the Polar High at 1032 mb was 11 mb above the climatic mean.

The upper air flow at 700 mb was mainly zonal between 35° and 50°N. Over the Gulf of Alaska it was southerly. The long-wave Low was centered almost directly over the surface Low at 2,802 m or 88 m lower than normal. The main High center was 3,203 m and west of the date line rather than east of it.

There were two typhoons, Dom and Ellen, and tropical storms Forrest and Georgia this month.

Extratropical Cyclones--The first storm of the month was east of Tokyo on the 1st. There already were gales, and a ship at 37°N, 144°E, had northeasterly winds of 46 kn. A ship closer to the center of the LOW had 26-ft swells. On the 2d the ASIA BRAVERY (42°N, 153°E) was 200 mi north of the storm with 48-kn winds. At 0000 on the 4th the 988-mb storm was near 47°N, 175°E. The storm was tracking more northward on the 4th. On the 5th a German ship at 53°N, 175°E, reported 50-kn winds with 40-ft swell waves. Late that day the storm weakened rapidly (fig. 89) and was gone by the 6th.

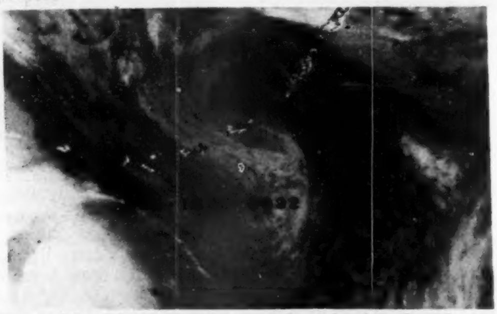


Figure 89.--The storm is near Atka Island in the Aleutians. Only low clouds are associated with it as indicated by the grey color.

This was a strong storm over Manchuria on the 4th, but it weakened as it approached the coast. By the 7th it was over the western ocean and again intensifying. The DIANA (40°N, 154°E) and the KISO MARU (37°N, 153°E) both had 52-kn winds from the east and north, respectively. At 0000 on the 8th the 993-mb storm was near 44°N, 172°E. Several ships continued to report winds between 40 and 50 kn. By the 9th the swell waves had increased to 23 ft near 42°N, 175°W.

The storm was 972 mb near the Pribilof Islands on the 10th, but the winds were mostly less than gale force. Another storm was approaching from the southwest and absorbing the energy and circulation.

A cyclonic circulation developed on the 9th over the northern Sea of Japan between two other LOWs to the north and south. By the 10th the new circulation was the only one left of the three. A Soviet ship near 50°N, 160°E, had 52-kn winds with 28-ft seas. On the 11th the higher winds were in the 40-kn range with waves up to 26 ft. At 0000 on the 12th the 976-mb storm was north of Atka Island. The strongest wind on the analysis was 40 kn from Cold Bay (fig. 90). On the 13th the storm was beginning to weaken, but the ALAIN L.D. (54°N, 158°W) found 43-kn winds and 16-ft seas. The storm had dissipated by the 15th.

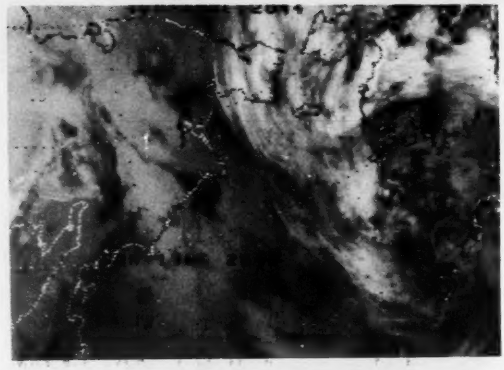


Figure 90.--The storm is centered north of the Pribilof Islands and has lost its upper air support as indicated by the lack of high clouds.

This was one of two storms that formed south of the Gulf of Alaska and traveled northward. Within hours of its formation on the 14th, the PRESIDENT TYLER had 45-kn winds. The storm was 980 mb by 1200 on the 15th near 49°N, 151°W. A ship within 1 mb of the center had 50-kn southerly winds (fig. 91).

Two ships had winds near 60 kn on the 16th. One was the VAN CONQUEROR near 51°N, 152°W, and the other SHIP was near 51°N, 159°W. On the 17th the VAN CONQUEROR was still reporting 52-kn winds. The LOW was absorbed by the next storm on the 18th.

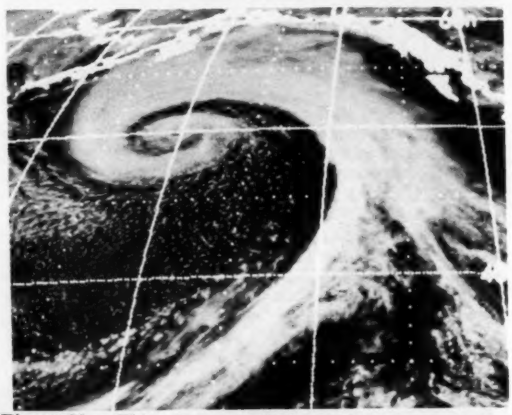


Figure 91.--This storm reached maturity very quickly.

Monster of the Month--This storm raced from the Yellow Sea to Kamchatka in less than 2 days. It traveled the Great Circle track from Korea to Oregon. At 0000 on the 16th it was 972 mb near 54°N, 155°E. The storm brought heavy rains to the Japanese Islands with a maximum of 95 mm (3.7 in) being reported. Newspapers reported 45-kn winds over the Sea of Japan. Thunderstorms formed along the front. It was during this storm that the AMOCO SEAFARER and CELEBRATION VENTURE collided near Osaka. The 1,622-ton NITTAN MARU and the 699-ton HOKUTO MARU collided in fog south of Ube Cape. There were no casualties among either crew. The KOEI MARU grounded. The weather forced the cancellations of 64 scheduled domestic aircraft flights. Ships near the Kurile Islands had gales. The CRYSTAL STAR (49°N, 155°E) found 44-kn winds and 25-ft swell waves. The JMMY (52°N, 166°E) was buffeted by 56-kn winds and 23-ft seas. The storm was raking the Bering Sea on the 17th with a central pressure of 956 mb. The JUNEAU MARU (52°N, 168°E) found 56-kn winds and 33-ft waves, while the PRESIDENT PIERCE (54°N, 175°E) was suffering only 35-kn gales with 30-ft waves. Others were suffering up to and including storm force.

The storm was producing gales and strong gales on the 18th (fig. 92). The STUYVESANT (60°N, 145°W) was south of Hinchinbrook Island with 45-kn winds from the southeast and 30-ft waves. The GLACIER BAY at 43°N, 153°W, was far to the south near the cold front with 40-kn winds and 21-ft waves.

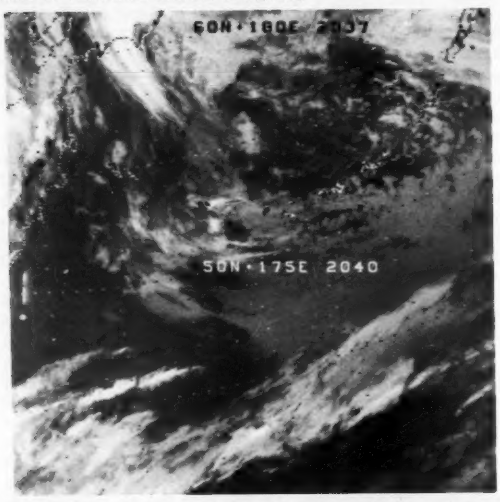


Figure 92.--For such a deep LOW the cloud system is very diffuse. No two systems are ever completely alike.

The storm crossed the Alaska peninsula and moved into the Gulf of Alaska on the 19th (fig. 93). The winds remained mostly gales with waves up to 25 ft. The exception was the GRAND GLOBE (52°N, 179°E) in the dangerous southwest quadrant, where she was hit with 58-kn winds from the west. She probably came under the influence of an area of positive vorticity advection in the upper air, which would increase the instability. The storm was weakening as it approached the coast. Far to the south (39°N, 155°W) and closer to the Pacific High than the LOW, the NEW GOLDEN PHOENIX found 45-kn winds. When the LOW moved ashore on the 23d, it was only a bubble in the analysis.

Figure 93.--The large storm is almost directly over OWS Papa. The brighter clouds north and south of the center generally indicate areas of bad weather.

This was a fast developing storm. It had its roots in an inverted trough southwest of and between two cells of the Pacific High. Normal observations from two ships identified the formation of the frontal wave on the 1200 analysis of the 18th. Twelve hours later it was a full-grown cyclone. At 1200 on the 19th the 996-mb storm was near 44°N, 163°E. The CHIN CHING was within 100 mi of the center with 26-ft swell waves. By 0600 on the 20th her winds had increased to 44 kn with 25-ft waves. The diameter of this storm was small and remained small. On the 23d the storm was traveling along the Alaska peninsula and pushing against a large Pacific High that extended into Alaska. The HIGH won on the 25th.

This was the extratropical continuation of typhoon Ellen. She turned extratropical late on the 21st east of northern Honshu and brought gales to ships in the area. A Japanese ship had 49-kn winds and 20-ft waves west of the center. On the 23d the NIPPO MARU southwest of the 976-mb center found 48 kn with 16-ft waves, while the TOYOTA MARU No. 1 was fighting only 40-kn southerly winds, but the swell waves were pounding her 30-ft line southeast of the center.

At 0000 on the 24th the 972-mb storm was at 51°N, 168°E. The PRESIDENT ADAMS was in the western outskirts of the storm near 50°N, 156°E, with 60-kn northerly winds and 23-ft seas. The storm spread its area of influence late on the 24th as a LOW over the Alaska peninsula was dying. The NEW GOLDEN PHOENIX (41°N, 168°E) was involved with this

storm to the tune of 55 kn. The center was traveling along the Aleutians. On the 26th it was moving northward over the Bering Sea to dissipate.

The last storm of the month formed over the Yellow Sea prior to the 0000 analysis of the 25th. It moved northeastward across the western Sea of Japan and then northward over the continent. It was bringing gales to the Sea of Japan on the 26th. The outer reaches of the storm were bringing winds over 40 kn east of Honshu. On the 27th the SHINZUI MARU (47°N, 157°E) and a Soviet ship, UUEJ (50°N, 155°E) had 55-kn winds from the southeast. Swell waves over 20 ft were being observed by other ships. The storm's center was on the western shore of the Sea of Okhotsk.

By the 28th the stronger outer fringes of the storm had retreated west of the Kurile Islands. On the 29th the storm broke up into multiple centers.

Tropical Cyclones, Western Pacific--Typhoon Dom formed in the southern Philippine Sea on the 9th. Heading west-northwestward, he reached tropical-storm strength on the 11th, shortly before crossing the 130th meridian near 12°N. As Dom approached the east coast of Luzon, he began recurving northward and gained typhoon status. Maximum winds reached 85 kn on the 13th as Dom brushed the Luzon coast. This encounter weakened the storm, and by the 15th he was a tropical storm heading northward. A day later Dom began turning toward the east. He regained typhoon strength for a few hours on the 17th, but weakened again. By late on the 19th, after recrossing the 130th meridian this time near 20°N, Dom fell to depression strength.

While Dom was buffeting Luzon on the 13th typhoon Ellen was coming to life among the Caroline Islands, just southeast of where Dom had formed. Ellen took a north-northwesterly track. She quickly reached typhoon intensity before crossing the 10th parallel near 142°E on the 15th. By the following day maximum winds climbed to 110 kn with gusts estimated at 135 kn. Ellen maintained this intensity into the 18th, remaining well west of the Mariana Islands (fig. 94). On the 20th, with 85-kn winds, she shifted to a more northerly course and accelerated. The following day winds fell to tropical-storm strength, and the storm turned east-northeastward after crossing 30°N near 137°E. This turn prevented Ellen from hitting Honshu. She continued to weaken rapidly.

About the time that Ellen was threatening Japan, tropical storms Forrest and Georgia were coming to life farther south. Forrest developed on the 19th in the Caroline chain, just west of Truk Island, while Georgia came to life in the South China Sea, near 15°N, that same day. Forrest headed west-northwestward, while Georgia took a northerly track. Forrest's maximum winds climbed to about 55 kn on the 24th shortly before he crossed the Philippines. The following day he made his way across central Luzon and into the South China Sea. He dissipated near 20°N, 115°W, an area crossed by Georgia just 3 days earlier.

Georgia had developed off the remains of a cold front that had passed through Hong Kong on the 15th. She attained tropical-storm strength on the 22d, some 340 mi south-southeast of Hong Kong. Late in the day 50-kn winds were blowing around her 987-mb center. Early on the 23d Georgia turned onto a north-northeasterly track at 11 kn. The CHEVALIER PAUL encountered 54-kn winds 60 mi to the west of Georgia's center, while the CLARA MAERSK reported 50-kn winds some 55 mi to the northwest. The weather radar at Hong Kong's Royal Observatory indicated heavy spiral bands to the east of the center, but little rain to the west. Georgia continued to move towards Shantou. She passed 90 mi east-southeast of Hong Kong late on the 23d. Early the next morning Georgia passed close to Shantou, where a minimum sea-level pressure of 990.2 mb and maximum peak gusts of 68 kn were reported. The highest sustained wind observed by a land station was 44 kn in Kinmen. In Hong Kong gales were experienced offshore and on hilltops during the afternoon of the 23d. Gusts in the area ranged from 25 to 73 kn, mainly out of the north-northeast through east. (This preliminary report on Georgia was furnished courtesy of Director, Royal Observatory, Hong Kong.)

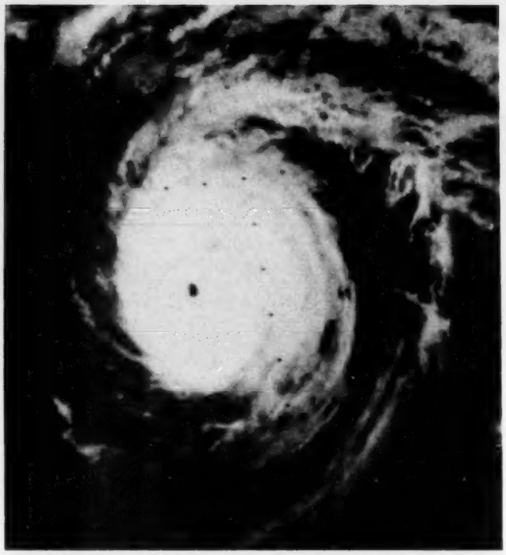


Figure 94. --Ellen is a compact severe typhoon late on the 18th.

Casualties--It wasn't until the 15th that a weather casualty was reported. Early that morning the 140,206-ton AMOCO SEAFARER and the 38,142-ton CELEBRATION VENTURE collided in rough seas in Kii channel near Osaka. Both vessels suffered damage. A few hours later the 498-ton KOEI MARU No. 5 grounded in rough seas off Shimotsu. On the 19th the 44,708-ton tanker AVRA was at Sasebo with heavy-weather damage.

Before dawn on the 22d the 10,224-ton ZENLIN GLORY sank after a collision with the 9,154-ton SEAWAY DISPATCH in fog in the Tsugaru Strait. The 21,475-ton PRESIDENT PIERCE requested a heavy-weather survey at Yokohama on the 23d. The 5,103-ton ZEPHUNTER requested a heavy weather damage survey on arrival at Osaka.

Other Casualties--The Indonesian ferry SAMUDERA INDAH sank on the 22d during a storm with 14-ft waves between the islands of Lombok and Sumbawa. Forty-four passengers were rescued, but 49 were feared dead.

Marine Weather Diary

NORTH ATLANTIC, AUGUST

WEATHER. The Azores High is still the predominant feature of the North Atlantic. It is elongated west-southwest to east-northeast with a central pressure of 1023 mb near 35°N, 35°W. The Icelandic Low is an ill-defined east-west trough of 1009 mb south of Iceland with a second center over Cape Chidley. The summertime air temperatures are still rising with a range from 4°C over Baffin Bay to 29°C over the Gulf of Mexico. The strongest temperature gradient is between Newfoundland and latitude 40°N. The extremes range from 0° to 32°C with the sea-surface temperature closely matching the air temperature. The sea and air temperatures along 40°N range from 20°C at Lisbon to over 24°C at 50°W and back 20°C off New York.

WINDS. Over the middle latitudes of the North Atlantic (35°N to 60°N) the prevailing winds are from the southwest, turn northwesterly off the Bay of Biscay and northerly off the west coast of Portugal. North of 60°N, the winds are northerly between Greenland and Norway but southerly between Greenland and Hudson Bay. Along the longitudinal band between 15°N and 30°N the winds are northeasterly over the eastern half and easterly or southeasterly over the western half. South of 15°N, winds prevail from the south, while over the Mediterranean Sea they are northwesterly with an average force 2 to 4. Average windspeeds over the North Atlantic maintain force 3 to 5. Over the Caribbean Sea the winds average force 4 to 5.

GALES. Winds of force 8 or greater rarely occur south of 52°N, except in tropical storms. North of this latitude gale frequencies of 10 percent occur southeast of Kap Farvel with a surrounding 5-percent area extending from Kap Farvel east to 25°W. Two smaller areas observing 5-percent frequencies of gales are the Davis Strait and off the west coast of Ireland.

EXTRATROPICAL CYCLONES. During August, principal areas of cyclogenesis extend from the Carolinas to the Gulf of St. Lawrence, from Newfoundland to southern Greenland, and over an elliptical area centered near 50°N, 23°W. Extratropical storm tracks have continued to move northward. Primary tracks lead from Lake Winnipeg to Baffin Bay and from the Great Lakes into northern latitudes, extending from the Labrador Sea to the Norwegian Sea. A secondary storm track for Lows crosses Great Britain and Denmark.

TROPICAL CYCLONES. The likelihood of tropical cyclones increases as August advances. Over an average 10-yr period, 25 tropical cyclones with winds of 34 kn or greater will be found in the North Atlantic with 15 of these reaching hurricane strength (64 kn or greater). The primary track of most tropical cyclones is either west of Florida heading towards the south coast of Texas or recurving east of Florida heading northeast paralleling the Atlantic Coast states.

WAVE HEIGHTS. Wave heights of 12 ft or higher have increased slightly since July and are encountered more than 10 percent of the time over an area that lies north of 42°N and extends from the Labrador Sea to Iceland. The area is roughly circular centered about 55°N, 27°W. A 300-mi-diameter area centered about 55°N, 22°W, has a less than 3-percent chance of waves over 20 ft.

VISIBILITIES. During August, fog becomes less frequent and extensive than earlier in the summer. Ten percent or more of the observations report visibilities less than 2 mi north of a line that runs from Long Island out past the Grand Banks where it circles northward through Iceland and then southward encircling the outer coasts of the British Isles before turning northeast through the Norwegian Sea. The highest frequency of poor visibility, 30 percent, occurs over the Bay of Fundy, the Grand Banks of Newfoundland, and the southwestern tip of Greenland. Areas along the coast of Greenland and from Cape Cod to Newfoundland report 20 percent or more of the observations with visibilities less than 2 mi.

NORTH PACIFIC, AUGUST

WEATHER. The North Pacific High is the dominant pressure system at 1023 mb. It covers the ocean from Japan to North America and from the Aleutians to latitude 10°N. A weak Aleutian Low is represented by a trough over eastern Siberia and the Bering Strait. The Low over southeast Asia brings the southwest monsoon to the area south and west of Japan. August is the warmest month of the year. The mean air temperature ranges from 7°C in the Bering Strait to over 28°C over the southwest ocean. The most concentrated air temperature gradient is along 40°N. Along this latitude the air temperature averages about 21°C from 150°W to Japan. Over the Sea of Japan at 40°N it is about 24°C, and between 150°W and the California coast it drops to 14°C at the coast. The sea-surface temperature has nearly the same range over the same areas, cooling to 16°C off the coast from California to Washington.

WINDS. The mean wind pattern during August is very similar to that of July. Prevailing southwesterly winds are found from northeastern Japan to Alaska and over the South China Sea. Southeasterly winds run from Micronesia to the Sea of Japan and the East China Sea. Northwesterly winds run along the east side of the Pacific High off the West Coast of the U.S. On the southern side of the High, the northeasterly trades lie some 600 to 800 mi off the southwest coast of North America and extend westward to Micronesia. Windspeeds average Beaufort force 3 for most regions of the Pacific. However, average windspeeds of force 4 are found in the following areas: Central Bering Sea, the east side of the Aleutians, south and east of Hawaii, and off the Northern California coast.

GALES. The frequency of gales is at a minimum this month with all regions reporting frequencies of less than 5 percent.

EXTRATROPICAL CYCLONES. The principal area

of cyclogenesis extends from the Sea of Japan to near 175°E and from 30°N to 50°N. One primary track runs through the eastern half of this area and crosses to the northwestern side of the Aleutian chain, near the Rat Islands, then eastward across the Kodiak Island and the northern portion of the Gulf of Alaska into southeastern Alaska and western Canada. A second primary track crosses southeastern Russia, Sakhalin Island, and the Kuril Islands. A secondary track extends from the western edge of the Aleutian chain northeastward through the center of the Bering Sea.

TROPICAL CYCLONES. August normally produces the greatest number of tropical cyclones across the North Pacific. The average number of tropical cyclones per year that reach tropical storm strength is 4.5 in the eastern North Pacific and 5.8 in the western North Pacific. Of these storms, 2.0 are expected to reach force 12 ($\geq$ 64 kts) in the eastern North Pacific and four in the western North Pacific.

WAVE HEIGHTS. Wave heights of 12 ft or higher have increased slightly. Frequencies of 10 percent or more are encountered in areas on both sides of the eastern Aleutian Island chain, off northern California and in an area between the Philippines and southern Japan.

VISIBILITIES. During August, visibilities less than 2 mi become less frequent and extensive over the North Pacific. Most regions north of 40°N report frequencies of 10 percent or greater. The area surrounding the Kuril Islands still has the highest frequency with half of the observations showing visibilities of less than 2 mi around the center islands. This is a 10-percent drop from the annual high in July.

NORTH ATLANTIC, SEPTEMBER

WEATHER. As autumn approaches the cyclone activity increases and moves southward especially off the North American east coast. This is the result of moderate intrusions of colder air from the continent. The Icelandic Low is centered southwest of Iceland with a mean pressure of 1004 mb and has become better defined. The Azores High is centered about 400 mi southwest of the Azores at 1021 mb. The mean air temperature has dropped from August, especially near the coasts and ranges from about 3°C over Baffin Bay to 28°C over the Caribbean Sea. Along the 40°N parallel the mean air temperature ranges from 19°C off the United States and Portugal to 22°C at 40°W. The sea temperature has changed only slightly with the 16°C isoline generally following the ship route from New York to the English Channel.

WINDS. Westerly winds prevail between 40°N and 60°N, with the exception of more northerly winds over the Bay of Biscay, the Portuguese coastal water, and the region south of Nova Scotia. Speeds across this latitude belt generally run force 3 to 5. South of 40°N, the prevailing winds, averaging force 2 to 4, are northeasterly over the eastern half and east and southeasterly over the western half. Winds are more variable north of 60°N, producing southwesterly winds over the Norwegian Sea and northerly winds over the water surrounding Iceland. At these higher latitudes the windspeeds average 3 to 5.

GALES. The frequency of gales are increasing, particularly over the northern latitudes. Frequencies of 10 percent are found just off the south and southeast coast of Greenland, while frequencies of 5 percent encompass a large portion of the central Atlantic north of 45°N. South of 40°N, winds of force 8 or greater are unlikely to be encountered except in storms of tropical origin.

EXTRATROPICAL CYCLONES. The frequency of extratropical cyclones is increasing and occasional severe storms may be encountered. The primary area of cyclogenesis extends from some 300 mi off Cape Hatteras to Newfoundland and east-northeastward to a point near 55°N, 25°W. Another area of major cyclonic development is off the northeast coast of Iceland. Since August, the extratropical cyclone tracks have shifted slightly south with primary tracks leading from off the northeast coast of the United States and Newfoundland towards the Norwegian Sea. Other primary tracks lead from the Great Lakes across James Bay to the Davis Strait and across southern Scandinavia. Secondary tracks cross the Bay of Biscay into the northwestern Mediterranean Sea.

TROPICAL CYCLONES. September is the peak season for tropical storm activity. September will average four or five tropical depressions that will reach tropical-storm strength with two or three of these reaching hurricane strength. Since 1871, the number of storms occurring in September has ranged from one to eight per year.

WAVE HEIGHTS. The frequency of wave heights 12 ft or higher has increased markedly as compared to the summer months. Frequencies of 10 percent or more extend from the Labrador Sea to the Norwegian Sea and as far south as 39°N west of the Azores. The highest frequency of 30 percent appears along a band 300 to 500 mi wide that extends northeastward from near 50°N, 32°W, to a point some 150 mi southeast of Iceland. This approximately same area south of 60°N is encompassed by a 5-percent probability of waves over 20 ft.

VISIBILITIES. The frequency and intensity of poor visibilities continue to decrease. Percent frequency of visibilities less than 2 mi exceeds 10 percent over the Bay of Fundy, the Grand Banks and coastal regions of Newfoundland, coastal regions of Greenland including an area that extends some 800 mi southeast of Kap Farvel, the Greenland Sea, northwestern Norwegian Sea, and British coastal waters. An area east of Cape Race has a frequency of 20 percent of the observations with visibilities less than 2 mi.

NORTH PACIFIC, SEPTEMBER

WEATHER. As autumn approaches the Aleutian Low moves southward over the Bering Sea and Gulf of Alaska as a closed 1007 mb circulation centered near Bristol Bay. The North Pacific High has started retreating eastward and is 1022 mb near 35°N, 145°W. The southeast Asian Low is filling and the southwest monsoon disappears. The mean air temperatures have decreased from the middle latitudes northward. They range from 3°C over the Bering Strait to 28°C over

the southwestern ocean. Along latitude 40°N the mean air temperature ranges within a degree of 20°C west of 140°W. Between 140°W and the California coast it decreases to 15°C. The mean sea-surface temperature ranges from 6°C through the Bering Strait to 28°C in the southwest ocean. Along latitude 40°N the sea temperature averages about 21°C west of 140°W, decreasing to less than 16°C at the California coast. The 98-percent range is generally about 4°C either side of the mean.

WINDS. The circulation pattern has begun to take on winter characteristics as the Aleutian Low becomes established again. Mean windspeeds have increased since August, with winds north of 40°N averaging force 3 to 5 and force 2 to 4 south of 40°N. Mean northerly winds are observed over the Yellow Sea, Sea of Japan, Bering Sea, and off the western coast of the United States and Mexico. South of 35°N, between 130°W and 130°E, prevailing winds are from the eastern quadrant while southwesterly winds prevail across the South China Sea. Westerlies prevail on the north side of the Pacific High north to the Aleutian Islands from Hokkaido into the Gulf of Alaska.

GALES. The frequency of gales increases slightly in September, particularly along the southern coast of Alaska. Frequencies of 5 percent cover the northern end of the Gulf of Alaska, Bristol Bay and the Bering Sea to as far west as 175°E, and south of the Aleutian chain from the Fox Islands to the Rat Islands in a band about 300 mi wide.

EXTRATROPICAL CYCLONES. During September, the principal area of cyclogenesis has decreased in size as compared to the summer months. It includes Japan and extends northeastward to near 50°N, 170°E. One primary track runs from near Tokyo to the Gulf of Alaska with a second one paralleling the first, from near 42°N, 178°E, to near 52°N, 145°W. A secondary storm track branches off the first primary storm track across the central Aleutians. Other secondary tracks extend across southern Sakhalin to east of the Commander Islands and across the northern portion of the Sea of Okhotsk.

TROPICAL CYCLONES. The frequency of tropical cyclones across the North Pacific in September nearly equals the peak in August. On the average 4.1 storms per year reach storm strength in the eastern North Pacific and 5.6 in the western North Pacific. Of these storms 1.8 will become hurricanes in the eastern North Pacific and 4.1 typhoons in the western North Pacific. In the western ocean these cyclones originate in low latitudes in the vicinity of 160° and travel westward. Near 130°E about one-third will turn north-northeastward while the rest continue into the South China Sea. In the eastern ocean the cyclones develop west of Guatemala and travel westward or turn northward to Baja California in equal numbers.

WAVE HEIGHTS. The number of areas where wave heights of at least 12 ft are observed 10 percent or more of the time is increasing. Frequencies of 10 percent are observed in most areas between 40°N and 60°N and between the Kuril Islands and the Queen Charlotte Islands. Similar wave regimes are observed off northern California and Vancouver Island and areas of the East China Sea and the Philippine Sea.

VISIBILITIES. A noted improvement in visibilities occurs over the North Pacific from the previous month. Visibilities of less than 2 mi now occur only 30 percent of the time along the Kuril Islands and southwest of Kamchatka, the worst area. Frequencies of 10 percent or more are roughly confined between 40°N to 60°N and 150°E to 135°W excluding the Gulf of Alaska north of latitude 55°N. Frequencies of 10 percent also occur along the California coast and in the northeast Sea of Okhotsk.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Environmental Data and Information Service
National Oceanographic Data Center
Mariners Weather Log
Washington, D. C. 20235

Postage and Fees Paid
U. S. Department of Commerce
Com-210
Controlled Circulation Rate

CURRENT SERIALS ACQUISITIONS
SERIALS PROCESSING DEPT
XEROX UNIV MICROFILMS
300 NORTH ZEEB RD
ANN ARBOR MI
48106